American Gas Journal

APRIL, 1958 | Only Magazine Edited Exclusively for the Gas Distribution Industry

ROCKWELL TIN METERS

ROCKWELL ALUMINUM METERS

For every low pressure service—EVERYWHERE

Gas meter needs vary throughout the country according to the user's preference and/or custom. Rockwell has no ax to grind. We make both tin meters and "hard case" aluminum meters. We make both types to the highest engineered standards. Both offer a long life of accurate performance as well as maximum maintenance ease and economy. Whatever your meter needs, whichever type of meter you prefer, you can buy with confidence from Rockwell. For bulletins, write *Rockwell Manufacturing Company, Pittsburgh 8, Pennsylvania.*

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ROCKWELL

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model 1100 gas regulator

modern... versatile.. accurate

You can't buy, beg, borrow or steal a more versatile pressure regulator than MODEL 1100. Nor has traditional Chaplin-Fulton ruggedness, simplicity or accuracy been forgotten in this new modern design. Size —2" only, screwed, flanged 125 or 250 ASA.

WIDER APPLICATION Inlet Max.—400 psi. Outlet Range—1" to 150 psi.

GREATER CAPACITY 24,000 cfh at 10 psi to ounces; 114,000 at 100 psi. Body contoured for flow.

EASIER MAINTENANCE Regulator or pilot can be serviced without disturbing the other. Quickly accessible orifices in both, easily renewable.

SIMPLER INSTALLATION Only one connection required. No complicated pins or toggles to adjust.

You can standardize on MODEL 1100 for a wider range of your industrial, commercial or distribution installations.

ACCURATE CF MFG CO DEPENDABLE

WSW 6835

Write for bulletin 1100

Chaplin-Fulton

MANUFACTURING COMPANY

Pittsburgh 25, Pennsylvania

TYPE 51

variable pressure pilot

The heart of the MODEL 1100 assembly, insuring precisely accurate control over the complete flow range.

- Unitized construction—valve lever and orifice as a unit are removed from the outside, without disturbing balance of assembly. The likely trouble spot—the orifice—is placed outside where you can get at it quickly—no internal tubes to clog.
- Twin diaphragms remove as a unit.
- Internal relief unit—guards against overpressure.
- Spring unit—remove three screws to change springs.
- Built for service.
- Used for accuracy.

Established 1859

American Gas Journal ®

ONLY MAGAZINE EDITED EXCLUSIVELY FOR THE GAS DISTRIBUTION INDUSTRY

April, 1958 Vol. 185, No. 4

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More Rockwell-Nordstrom lubricated plug valves are used in gas distribution than any other valve. The reason is simple . . . no other valve has proved itself to be so completely dependable and trouble-free.

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Rockwell-Nordstrom valves are available in a complete range of sizes in wrench, gear and power operated patterns to meet any distribution need. They cost no more to buy, often less, than ordinary valves. Write for details: Rockwell Manufacturing Company, Pittsburgh 8, Pennsylvania. *Canadian Valve Licensee: Peacock Brothers Limited.*

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it's **ROCKWELL**

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American Gas Journal

Established July 1, 1859

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Fuel for Thought

EXPERIENCE is a great teacher and if experience is to leave any lasting remembrance to the gas industry it may well be that our industry must always remain "on its toes" and be aggressive.

Case in point is a national promotion program instituted by a leading manufacturer of insulation materials for the housing industry. The firm, a major factor in its industry, is currently conducting a $3,000,000 advertising program in one of the nation's largest consumer publications. It is also furnishing complete prepared literature and merchandising aids to builders participating in its program.

Purpose of the program, naturally, is to promote the use of insulating materials to provide maximum comfort for the homeowner by reducing heating and cooling costs.

But . . . the firm also requires participants in its program to display promotion on "full housepower," regardless of what type fuel the builder is using in his product.

Members of the gas industry, noting the advertisements and the promotion program, objected to the fact that the gas industry had been excluded and ignored. Following meetings with members of the firm promoting the insulation, the company agreed to give comparable consideration in its advertisements to the use of gas as well as electricity. But, the "full housepower" copy still predominates the ads.

This firm has also made another minor concession to the gas industry — allowing participating builders, at their discretion, to feature a panel on outdoor signs at their show-homes, stating "Gas Equipped . . . by . . . ." Regardless, the builder must also always show the "full housepower" sign.

In all, gas plays only a small part in this gigantic promotion. This is strange, because the company involved enjoys good relations with the gas industry. Its products are used by most major manufacturers of heating equipment, gas ranges, water heaters, and incinerators, as well as being used by many transmission and distribution companies in tremendous quantities for pipe wrapping.

The failure of such a large non-gas-industry corporation to completely overlook or ignore the gas industry poses a puzzling question: Why should electricity be given a top billing to the exclusion of gas? Surely there must have been good reasons at the beginning. Perhaps the gas industry just doesn't promote itself enough. Or perhaps the advertising agency for the firm is sold that "electricity means modernity" and has closed its eyes to other fuels and energy sources.

Perhaps — and it is worth pondering — the gas industry's public relations program isn't as effective as we think it is.

The gas industry — as we commonly term the collective enterprise of everyone concerned with finding, producing, transporting, and selling gas — is the nation's fifth largest industry. Certainly no individual corporation that supplies such a large segment of the nation's economy would want to get into "hot water" by ignoring it.

But certainly the nation's fifth largest industry should be so well recognized that no one would want to overlook it or ignore it.

Maybe we aren't telling our story often enough, or loud enough, to enough people.

— *The Editors*

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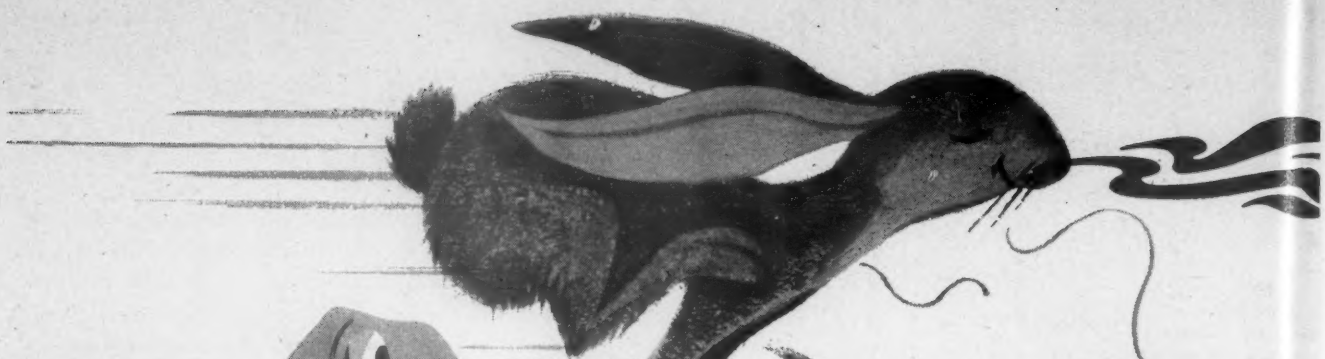

ORONITE®

Our apology to Aesop for letting the rabbit finally win a race. We at Oronite think it only fair.

out front on ODORIZATION and technical service

With Oronite *technical assistance* is a defined course of action embodying a group effort of scores of technically trained people specializing in gas odorization.

Most important is the Oronite philosophy of translating gas odorant research to your individual needs. Oronite recognizes that many odorant applications are different and that technical assistance must be provided to meet individual requirements.

Oronite's field representatives are familiar with odorant problems and their solutions; our odorant specialists continually supply field men with new odorant data and application information; in the laboratories, a section of research chemists and engineers continually explore and document new odorization data.

When a company becomes an Oronite customer, technical service continues. Oronite's odorant program is one of testing and providing new safety factors, providing new information and data as it develops, suggesting ways of cutting costs — cooperating in every way possible to make your association with Oronite more valuable.

Technical Service is a proven fact at Oronite. Why not call Oronite and see for yourself the department of technical assistance offered you on your odorization problems.

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4703

Coming Events

IN THE GAS DISTRIBUTION INDUSTRY

March

31-April 2 GAMA, annual meeting, Greenbrier, White Sulphur Springs, West Virginia.

April

8-10 AGA sales conference on industrial and commercial gas, Hotel Schroeder, Milwaukee, Wisconsin.

10-11 AGA subcommittee 8 of ASA B31, Greenbrier Hotel, White Sulphur Springs, West Virginia.

14-16 AGA national conference of electric and gas utility accountants, Shamrock Hilton Hotel, Houston, Texas.

15-17 Southwestern Gas Measurement Short Course, University of Oklahoma, North Campus, Norman, Oklahoma.

17-18 Indiana Gas Association, annual convention, French Lick-Sheraton Hotel, French Lick, Indiana.

21-23 AGA research and utilization conference, Hotel Carter, Cleveland, Ohio.

28-30 SGA annual convention, Dallas, Texas.

29-30 PCGA distribution conference, Tucson, Arizona.

29-May 1 PIEA-PESA, joint convention, Adolphus Hotel, Dallas, Texas.

May

1 PCGA accident prevention conference, Tucson, Arizona.

4- 7 LPGA annual meeting, Conrad Hilton Hotel, Chicago, Illinois.

4- 7 Air Conditioning & Refrigeration Institute, annual meeting, The Homestead, Hot Springs, Virginia.

5- 9 AGA distribution, production, and transmission conference, The Roosevelt and Commodore Hotels, New York, New York.

5- 9 National Restaurant Association convention and exposition. Navy Pier, Chicago, Illinois (AGA will exhibit).

5- 9 AGA commercial gas school, Edgewater Beach Hotel, Chicago, Illinois.

12-16 PCGA industrial gas school, Los Angeles, California.

15 NEGA operating division, Sheraton-Biltmore, Providence, Rhode Island.

18-21 Industrial Heating Equipment Association, The Homestead, Hot Springs, Virginia.

19-21 AGA mid-west regional gas sales conference, Edgewater Beach Hotel, Chicago, Illinois.

19-23 National Fire Protection Association, annual meeting, Palmer House, Chicago, Illinois.

20-21 PCGA customer service conference, Olympic Hotel, Seattle, Washington.

20-22 Pennsylvania Gas Association, annual meeting, Pocono Manor Inn, Pocono Manor, Pennsylvania.

22-24 Florida-Georgia Gas Association, annual management conference, Key Biscayne Hotel, Key Biscayne, Miami, Florida.

23 Southeastern Gas Association, gas distribution conference, Selwyn Hotel, Charlotte, North Carolina.

June

1- 4 Institute of Appliance Manufacturers, annual convention and exhibit, Netherland Hilton Hotel, Cincinnati, Ohio.

you can depend on Lone Star API pipe

...quality controlled for long, trouble-free service

Crossing rivers, bending over steep hills and rugged terrain is routine for Lone Star electric weld line pipe. Joe Roughneck, heart of the oil and gas industry, knows he can depend on Lone Star API casing, tubing and line pipe . . from the oil country's own steel plant. Fully normalized, of course.

Neighbor, wherever you are, specify Lone Star and we both get a good deal.

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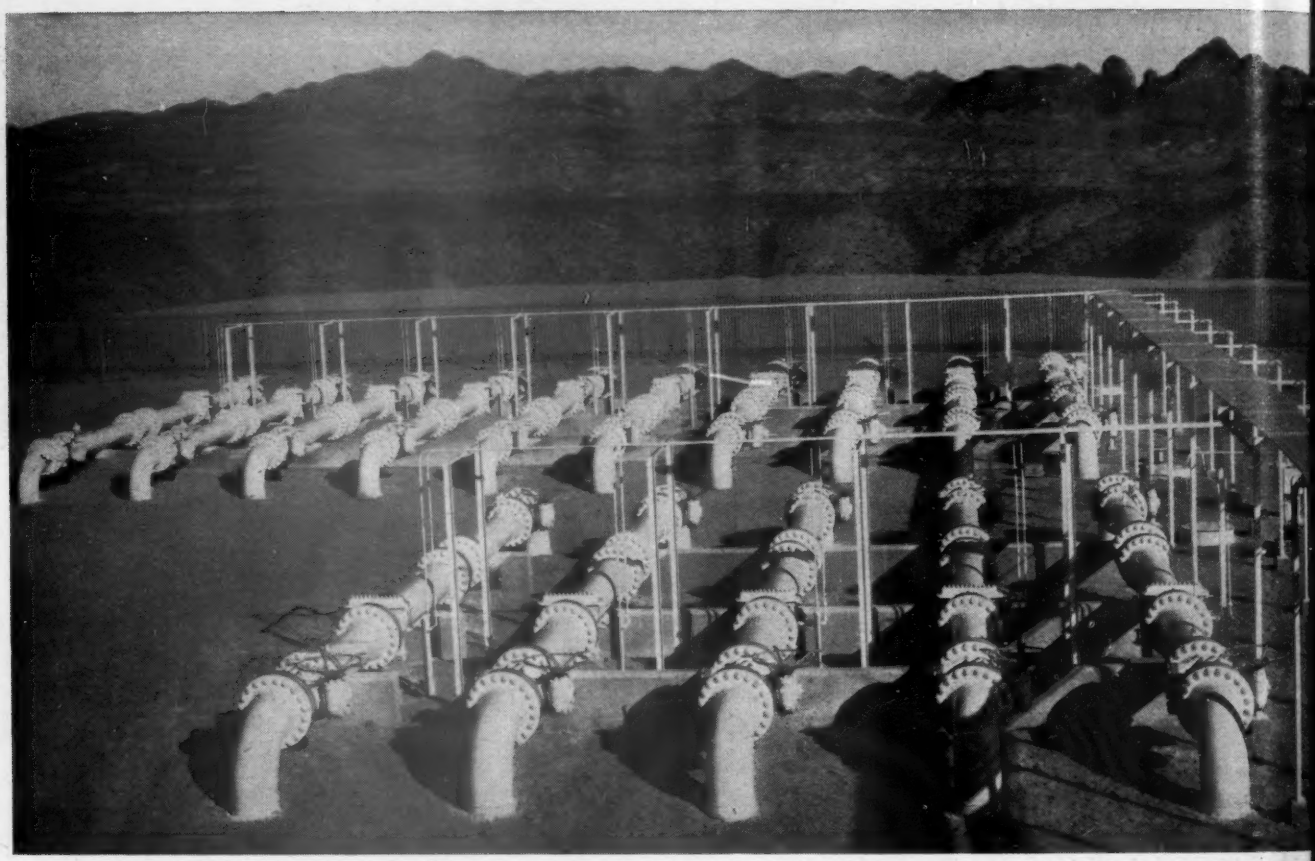
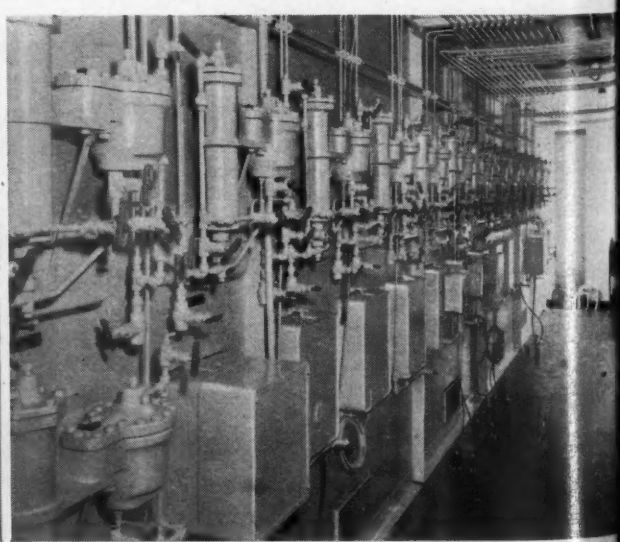
Topock... where



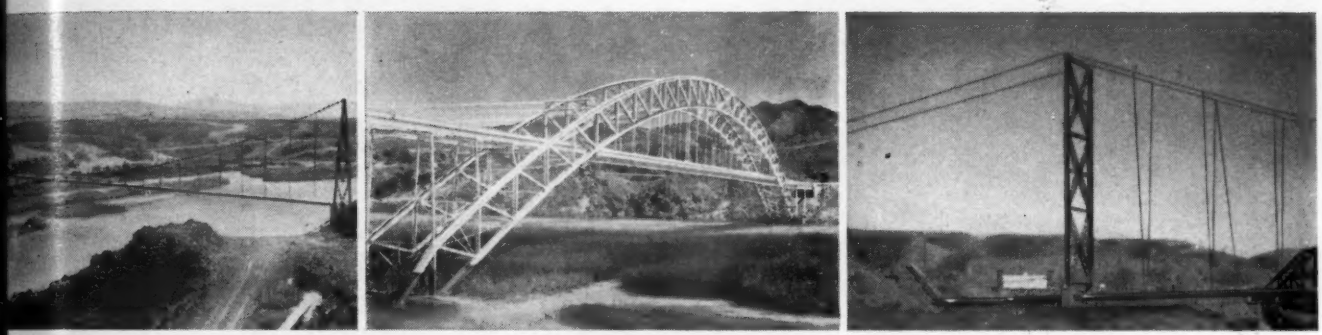
Fifteen 16" Meter Runs are at Topock. Gas transmitted through this installation goes to Pacific Gas and Electric Company, Southern Counties Gas Company, Southern California Gas Company and Nevada Natural Gas Company.

Instantly Available to dispatchers at all times, are readings from the American Orifice Meters on the panel board. Charts are changed daily and mailed to a central point for integrating and billing.

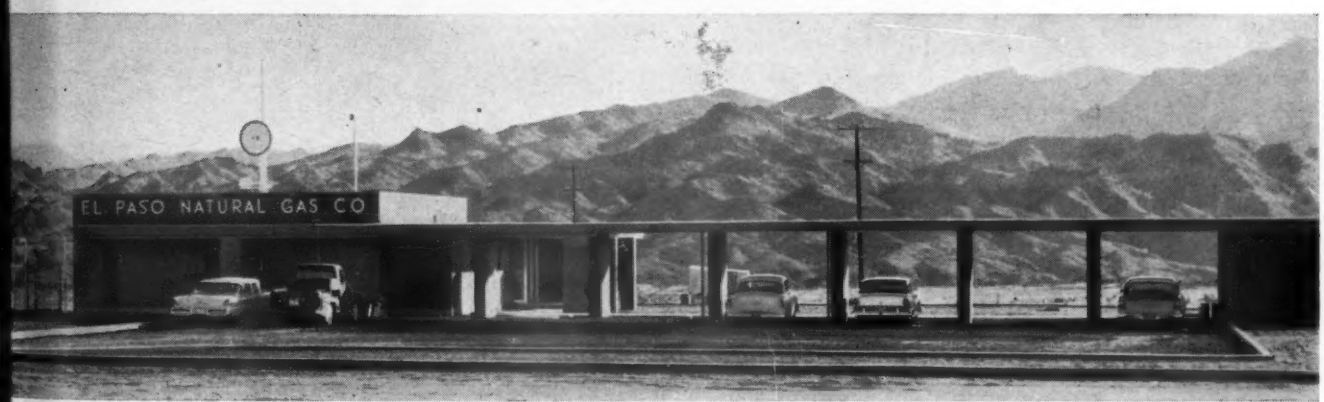


American Orifice Meters on back of panel board a A-20's. 100 inch range mercury manometers are d signed for operation up to 1800 psi working pressur

American® meters measure nearly 1½ billion cu. ft. of gas per day



Topock Means Bridge in Indian language. These three 1,000 foot bridges carry two 30" and one 34" pipe line across the Colorado River for transmission to California. The natural gas in each aerial line weighs about six tons.



At Topock, Arizona, on the banks of the Colorado River, almost one and one-half billion cubic feet of natural gas a day, piped across the desert from New Mexico, Colorado and Texas, are mixed to supply the uniform BTU natural gas for the growing needs of California and Nevada. Metering and control is effected at this ultra-modern air-conditioned desert station. Because of the immense volume of gas measured at this point, minute errors could result in losses amounting to hundreds of dollars a day.

Here, fifteen American Orifice Meters, each capable of measuring and recording 100 million cubic feet of gas a day at 500 psi, provide the sustained accuracy required, for measuring the largest volume of gas flowing through any metering station today.

American Meter engineering assistance, and American precision equipment are available for every measurement and control problem. *Call* or *write* your nearest American Meter Company representative.

AMERICAN METER CO. 1874

AMERICAN METER COMPANY

INCORPORATED ESTABLISHED 1836

GENERAL SALES OFFICE: Philadelphia 16, Pennsylvania
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SUPPLIERS TO THE GAS INDUSTRY for Ironcase, Tinned Steelcase, Aluminumcase and Welded Steelcase Meters • American Westcott Orifice Meters • Instruments • Reliance Regulators • Apparatus • Valves

Cut Maintenance and Replacement Costs with TAPECOAT®

... the Coal Tar Tape Coating that Adds Years of Service Life to Gas Lines

No wonder more and more distribution engineers are selecting TAPECOAT products as an important part of their program in fighting underground corrosion! Experience shows that quality protection applied during installation prevents huge maintenance and replacement expense at later dates.

Since 1941 when TAPECOAT originated coal tar coating in tape form, it has proved to be the best protection money can buy for combatting corrosion underground or under water. Lines in service TAPECOATED as far back as 17 years ago show no signs of deterioration – a record of uninterrupted service no other type of tape can match.

TAPECOAT comes in rolls of 2", 3", 4", 6", 18" and 24" widths–sized to the job for protecting pipe, pipe joints, couplings, fittings, tanks, conduit, cable and tie rods. TAPECOAT is both bond and protection in one–easy to apply with the flash of a torch.

Write for brochure today.

When primer is specified, use TC Primecoat, the compatible coal tar primer.

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Made of malleable iron. Single massive bolt. All sizes, 1/2" to 12" inclusive. For steel, cast iron and Transite pipe.

M. B. SKINNER COMPANY

SOUTH BEND 21, INDIANA, U. S. A.

SKINNER-SEAL SERVICE SADDLE

The new Superior ALUMINUM CASE METERS

. . . the slow-motion meters you can rely on longer

This slow-motion, long-lived meter operates at only 7 revolutions per cubic foot to reduce wear and stay accurate longer. And its simple, horizontal seam construction gives fewer chances for leaks . . . makes maintenance quick and simple. Whether it's adjusting the tangent through the handy access in the top . . . removing the top to grind the valve seat . . . or lifting out the valve table with the entire inner movement to replace the diaphragm, simply loosening a few screws makes everything accessible.

Get full details. Send for bulletin 1150.

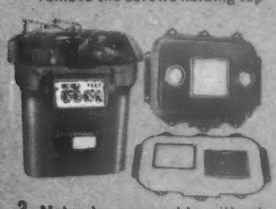
This modern meter exploits all the time-tested advances in meter technology *plus* the latest manufacturing techniques of Superior's new plant.

SUPERIOR METER COMPANY, INC.
19 West 50th Street, New York 20, N. Y.
A SUBSIDIARY OF NEPTUNE METER COMPANY

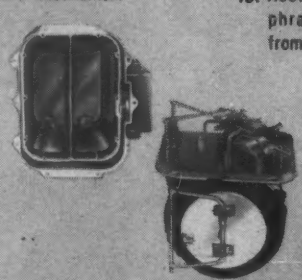
neptune

Look at these advanced design features:

1. Simple, horizontal seam . . . eliminates leakage . . . easier maintenance
2. Easily accessible table . . . just remove the screws holding top

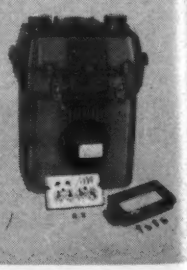


3. Meter top removable without taking off index box
4. Valve seat readily accessible for grinding when top is removed
5. Slow movement; only 7 revolutions per cubic foot
6. Seam gasket stays resilient . . . cork and Buna-N composition
7. Valve table lifts out with entire mechanism



8. Heavy-duty, sintered bronze bearings oil-impregnated for life
9. Flag arrangement gives arm smoother operation and longer life
10. Accurately controlled diaphragm . . . no inaccuracies from deflection
11. Cupped handling lids permit easy and safe carrying
12. Handy access for tangent adjustment and calibration
13. Broad base for solid stacking . . . designed for conveyorized handling
14. Index removable without removing meter

In 250 cfh and 340 cfh sizes to meet most domestic requirements.



Mcf

Merger of Spokane Natural Gas Company with Washington Water Power Company, an electric utility, may produce another combination utility in the northwest if stockholders of the two firms approve by May 9. Reasons cited for the proposed merger are that the combined operation would result in better organization, financial credit, and improved service to customers.

A male customer of Lone Star Gas Company in Bonham, Texas, has summed up "modern living" with natural gas in a most appropriate way — "These automatic gas ranges and canned biscuits have almost done away with the need for a woman!"

Negotiations are underway for the acquisition of Empire Southern Gas Company of Fort Worth, Texas, by Pioneer Natural Gas Company, Amarillo, Texas. Pioneer proposes issuance of 187,818 shares of common stock for all properties and assets of Empire, and will assume all of Empire's liabilities. After transfer of assets and liabilities, Empire would be dissolved, and the Pioneer shares distributed to Empire stockholders in cancellation and redemption of 206,600 outstanding shares of Empire stock. Empire, with general offices in Fort Worth, distributes natural gas to Big Spring, Pampa, Brady, Ozona, Gorman, and Panhandle, all in Texas, and Minden, Louisiana.

Transwestern Pipeline Company, a new transmission firm with headquarters in Houston, Texas, has agreed to furnish 350,000,000 cu ft of gas per day to Pacific Gas Lighting Supply Company, providing the latter firm with its first long-term, out-of-state supply of natural gas. Pacific is parent company of Southern California Gas Company and Southern Counties Gas Company, both of Los Angeles. Both SoCal and SoCos now purchase their supply of out-of-state-originated gas directly from El Paso Natural Gas Company. Transwestern has applied to the FPC for approval of construction of its proposed 1200-mile system.

Expansion of daily delivery capacity by 300,000,000 cu ft is proposed by Southern Natural Gas Company for the 1958-59 winter heating season, in application filed with the FPC in early March. Distribution company customers will benefit from the plan provided that the company can work out satisfactory settlement with its customers of presently pending rate proceedings and make arrangements with them to handle any future rate increases when necessary—as it had been able to do prior to the *Memphis Case* decision. Southern Natural's proposed program would involve construction of 1200 miles of pipeline to gather gas from 35 new South Louisiana and Gulf of Mexico fields and for loops of its existing southern system.

Death of an industry? In a scorching report of its second study in three years of the Warm-Air Heating Industry, the American Institute of Management warns that "the Warm-Air Heating Industry may well cease to exist as a separate entity." The reason cited by AIM is "failure of an entire industry to perform properly." Among causes cited is lack of co-ordination between manufacturer and user of furnaces. And, bluntly states AIM, major industrial giants are steadily creeping into the field with subsidiaries that are challenging the numerous low-profit-margin independents that have constituted the industry for so long. In its report, AIM noted that:

- . . . of 20,000,000 centrally heated homes in the U. S., fully 80 percent tested in the past six years, the heating installer failed to accurately calculate the heat loss of the house — basic requirement for design of any good system.
- . . . inadequate installation and improperly adjusted controls cause even more trouble.
- . . . most heating installations are seriously substandard.
- . . . most dealers don't know or are unwilling to learn how to properly adjust or balance a heating system.
- . . . furnaces themselves are not at fault.
- . . . almost half of the nation's 38,000,000 single family homes still are not centrally heated; over 15,000,000 homes heated by warm air were installed before World War II.
- . . . standards are not enforced.
- . . . there is a serious lack of municipal codes on replacement and repairs of furnaces, perpetuating the basic difficulty.

Michigan Consolidated Gas Company has entered suit against Panhandle Eastern Pipe Line Company for $17,000,000, alleging that the pipeline firm illegally deprived MichCon and its customers of some 100-billion cu ft of gas in the past six years. The suit charges that since February 20, 1952, Panhandle has been required by FPC orders to sell MichCon and other utility customers certain large quantities of excess gas available on its system. MichCon says it made repeated efforts to purchase up to 100,000,000 cu ft per day for storage and industrial sales, but Panhandle refused to sell the excess gas in accordance with FPC orders. Instead, alleges the suit, Panhandle illegally sold the gas to certain industrial customers and made unauthorized and improper deliveries to a few selected customers.

Rainbow of colors offered by George D. Roper Corporation on its built-in gas ranges has been trimmed to five popular finishes. Struck from the list were such aesthetic hues as Regency Yellow, Panchromatic Sand, Cocoa Brown, Nile Blue, Cadet Blue, Sea Mist Green, Black, and White. Customer capturing colors remaining include Petal Pink, Turquoise Green, Canary Yellow, Bronze Porcelain, and Satin Chrome.

Regulatory Notes. A compromise four-percent franchise tax on gas and electric utilities, for a two-year period only, has been passed by the *New Hampshire* legislature. . . . Proposed state constitutional amendment to abolish the *Arizona* Corporation Commission as an elective body and make it appointive has been introduced in the state legislature. The commission functions as a regulatory agency over public utilities . . . Baltimore Gas & Electric Company has been given an okay by the *Maryland* PSC on plans to issue $30,000,000 in bonds to finance expansion of facilities.

JOSLYN ANNOUNCES NEW COMPRESSION COUPLINGS*

ELECTRICALLY-CONDUCTIVE TYPE 212 COUPLINGS NOW AVAILABLE FOR CATHODIC PROTECTION

THREADLESS PIPE JOINTS FOR ANY LIQUID OR GAS—WATER, OIL, GAS, CHEMICALS, ETC.

At last, a compression coupling specifically designed to provide a low-resistance electrical joint essential to cathodic protection systems.

The Joslyn Type 212 E-C Coupling combines all the features of the Type 210 Standard Coupling and, in addition, assures sealed-in bond when compression nuts are tightened.

Both types simple to install, fully re-usable, permanently leak-proof, and economical.

Design eliminates thread-cutting and close fitting of pipe—insures compression seal of gasket without friction or seizure—produces high compression sealing force at gasket surfaces.

Available from stock at Joslyn Warehouses all over the country.

Write Department TS-3 For Complete Information

Also available in other materials for special applications *Patent No. 2,816,472

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MFG. AND SUPPLY CO. **WM. E. PRATT FOUNDRY DIVISION**

155 North Wacker Drive • Chicago 6, Illinois

Prepared by Leo T. Parker, attorney at law and contributing editor

Police Protection Taxes

What are the rights of a city to tax a gas corporation under the guise of "police power," and are such taxes on business done outside the city limits valid?

It is true, of course, that a majority of city tax laws are valid and enforceable. Conversely, many higher court decisions are on record declaring such taxation void.

First, it is important to know that licenses, ordinances, and other taxation laws are void if they are unreasonable, discriminatory, or arbitrary. Also, no municipality has a natural right to assess a license or tax on gas companies. Such authority must arise from the state statutes or the state constitution. And, city ordinances are void that are prohibited by a federal or state law, or contradictory to the United States or state constitutions. Moreover, a city ordinance that taxes gas corporations is invalid if the same taxes are being collected by the state, or if the city taxing ordinance conflicts with a state law.

Under the municipal "police power," granted by laws of all states, all things that are injurious or detrimental to the public may be suppressed, policed, regulated, or prohibited. Hence, valid license fees or taxes may be assessed to defray municipal expense in enforcement, inspection and other necessary actions. The amount of tax, however, as a police measure, may not be out of proportion to the expense of the city to police or regulate the taxed business. A leading higher court decision involving these points of law is *Alabama Gas Company v. City, 30 So. (2d) 651.* Facts of this case are that the gas company for many years furnished natural gas for heating, lighting, and power to consumers within a city and also, to a number of consumers outside the corporate limits, but within the police jurisdiction of the city. One branch of the gas company's business consists of selling gas appliances and fixtures, and it operated a retail store for that purpose. Gas company employees installed pipes and appliances in the various customers' houses and charged the customers for this service as any other plumbing concern or gas fitter charges.

An ordinance was enacted by the city that specified a license tax on the gas company for business "carried on" in the city of Montgomery. Another ordinance was passed that prescribed a license fee for engaging in business outside the corporate limits of the city, but within the city's police jurisdiction. This fee was equal to one-half the license tax for the company engaging in business within the corporate limits of the city.

The gas company paid all license taxes claimed by the city for gas furnished for heating, lighting, and power purposes to consumers within the corporate limits of the city, but it refused to pay the license tax for gas furnished for consumers outside the corporate limits of the city.

It is interesting to observe that the higher court held that the gas company need not pay taxes specified by both ordinances, and said:

"It may be that a utility has some tendency toward a need for police supervision, though the agreed facts show that it has never called into use such power in respect to this situation. If the 2 percent charge in a city has any relation whatever to police supervision, it cannot with any reasonable analysis be said to be responsible for half of the charge. But if it were, then there would be as much charge for supervision without as within the city, which is contrary to the spirit of the authority conferred, since the amount of the charge for police supervision is effected by the populousness of the community."

In other words, this court held that the ordinance was void primarily because the city attempted to tax the gas company one half the amount for police supervision outside the city as it was taxed for police supervision within the city. The fact that the expense of police supervision outside the city was considerably less than ½ the cost of city supervision resulted in the tax law being invalid.

For comparison, see *Alabama Power Company v. City of Carbon Hill, 175 So. 289.* This court said:

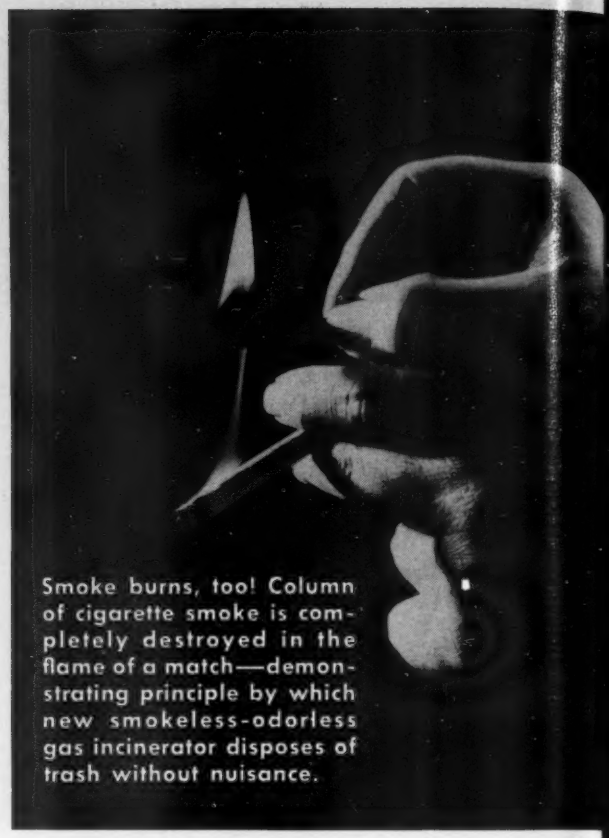
"We declare the true rule to be that, as an exercise of police power merely, the amount exacted for a license, though designed for regulation and not for revenue, is not to be confined to the expense of issuing the license; but that a reasonable compensation may be charged for the additional expense of municipal supervision over the particular business or vocation, at the place where it is licensed. For other higher court cases which hold likewise, see *Ash v. People, 11 Mich. 347; Carter v. Dow, 16 Wis. 298; Tenney v. Lenz, 16 Wis., 566."*

When a city fixes the amount of a license charge or tax for business conducted within its limits, it may include an amount for revenue and an additional sum for police regulation. Generally speaking, this same rule of law is applicable to a gas company located in a city, and which does business outside the city limits. If police, fire, sanitary or other regulations are needed to safeguard the health, morals or safety of citizens either in the city or outside its city limits, it may tax the local business and also the business transacted outside the city, but always it must be in proportion to the expense of supervision. If the expense of supervision outside the city is less, then the tax must be proportionally less.

In *McLendon v. Kerr, 97 So. 145,* the court said:

"If the city is dealing with a business which is reasonably classed as inherently or potentially injurious to the sanitation, health, peace, and comfort of the inhabitants or conditions in it, and imposes a license charge for doing business in the city, primarily predicated on the ground that it is a police measure it may not be improper to fix as a charge on such a business in the police jurisdiction an amount reasonably proportionate to the charge on such a business in the city." * * *

Cigarette producing a cloud of smoke is key factor in demonstrating how the new incinerator works, burning smoke and odors as it reduces trash to fine ash.



Smoke burns, too! Column of cigarette smoke is completely destroyed in the flame of a match—demonstrating principle by which new smokeless-odorless gas incinerator disposes of trash without nuisance.

An AGJ Special Report:

New Smokeless-Odorless Incinerators Provide Answer to Pollution Problem

WHILE GAS MEN LOOKED ON CONFIDENTLY (and hotel aides a bit apprehensively) a seven-pound assortment of chicken feathers, grapefruit rinds, egg shells and other kitchen debris was reduced to a handful of fine ash in the unlikely surroundings of the French Room of Chicago's plush Sheraton-Blackstone Hotel last month. The occasion was the introduction of new lines of household gas incinerators to show that they merit the "smokeless-odorless" label given them. With such incinerators, gas industry representatives anticipate, millions more Americans will be able to burn up their garbage and trash right at home. The demonstration was arranged by the domestic incinerator division of the Gas Appliance Manufacturers Association.

These new smokeless-odorless incinerators, say industry representatives, can help solve the nation's huge refuse disposal task without adding to its air-pollution woes — and indeed, in many

. . . new units introduced at successful demonstration in Chicago hotel

. . . prospects for building additional utility load are unlimited; only 1 in 900 gas customers now has an incinerator

Lab Test. Testing of new smokeless-odorless domestic gas incinerators by a number of gas utilities is one of the present activities that manufacturers believe may lead to wider markets. Here, at Brooklyn Union Gas Company's appliance testing laboratory, Gebhard G. Beck, right, gas utilization engineer, peers through a viewing chamber that permits him to examine products of combustion for possible smoke. Frank Baranowski, a serviceman, charges the incinerator.

"NO SMOKING" zone. Special viewing chamber in venting apparatus at demonstration of smokeless-odorless household gas incinerator permitted guests to see how appliance lives up to its name. Thomas H. Carey, right, Chicago's director of air pollution control, takes a look, while the opposite pane is occupied by Harold Massey, GAMA managing director. Model Mary Jane Clark is shown with the refuse burned in the test, conducted in a salon of Chicago's luxurious Sheraton-Blackstone Hotel.

places, actually helping solve air-pollution problems.

Models are being put into production by seven manufacturers who foresee wide gains for the appliance in many areas of the country, including some sections where gas incinerators now are little used. The new models have passed, or are undergoing final tests, under the revised approval standard set by the American Gas Association Approval Requirements Committee and made effective January 1.

Keen utility interest in the new models is reported by GAMA's gas incinerator division, which conducted the unusual introduction demonstration. The event was timed to coincide with the National Association of Home Builders Show.

The incinerator was installed in such a way that guests at the demonstration could not only check its ability to keep smoke and odors out of the demonstration area but also could see and sniff the waste gases vented from the premises. As with earlier models, home installation of the new smokeless-odorless incinerators requires venting to an adequate chimney.

Except for the demonstration attachments, the incinerator tested was a regular model of the type manufacturers and gas utilities expect to see installed in millions of basements, utility rooms, and kitchens over the coming years. Available in white or light colored enamel, the incinerators are appliance-styled, the usual counter height of approximately 36-in., and about 22-in. wide.

All Charged Up

To show that a rugged and ingenious interior lay beneath the external elegance, the incinerator was given a typical day's disposal job in a typical household — plus additional hard-to-burn combustibles just to let it show off. In all, this included some 4½-lb of garbage, plus paper to bring the total weight of the "charge," (what incinerator men call the garbage and trash their appliance burns up) to seven pounds.

A knob was turned and the gas flame did the rest, burning up smoke and odors while reducing the whole refuse load to a handful of fine gray ash in the bottom compartment.

It's the second part of the job — the burning up of smoke and odors — that has received years of attention, and many hundreds of thousands of dollars in research funds, from manufacturers, gas utilities, and their associations over the years. The principle is easily demonstrated — it's the same as what you can see happening when a stream of smoke from a cigarette vanishes as it hits the flame of a match. Many difficult technical problems were involved in putting the principle to practical use.

"Double-Burning" Trick

Essentially, though with variations in different makes, the new incinerators include a sort of "double-burning" operation. After the first stage of combustion, the waste gases are mixed with air, subjected to heat and flame, and rendered inoffensive as they themselves are burned.

The interior may be compartmented so that the same flame does both jobs, or there may be more than one flame, and an after-burner arrangement. The intensity of flame and the flow of air are exactingly controlled. But all this is done automatically, and the housewife, after depositing the refuse and turning the knob, has completed her role. The incinerator turns itself off after the pre-set operating period, usually an hour or two.

The new gas incinerators dispose of almost any sort of waste material except non-combustibles such as metal and glass. Thus, wet or dry rags or paper, wood chips from handcraft projects and many other things can be parts of the disposal load. Insulation of glass fiber and metal foil prevents the incinerator from heating up excessively on the outside as it is used. Typical capacity is about one and a half bushels. The incinerator has controls to shut off the flow of gas should the pilot light be extinguished.

Most models of new smokeless-odorless incinerators will sell for $175 to $200. Fuel costs vary with models and local rates, but manufacturers report that for many areas the operating cost is five cents a day or less.

Significance of these new smokeless-odorless incinerators in terms of helping to solve municipal air pollution problems was highlighted in Chicago when Mayor Daley announced that he would introduce an ordinance banning outdoor trash burning.

GAMA officials believe the new incinerator will help solve the mounting smoke and smog problem in densely populated cities. It also will prove to be a boon in smaller communities where the shortage of dump space is becoming serious.

Los Angeles and Detroit, among the larger cities, enforce strict regulations governing refuse disposal. Other cities also have enacted effective laws in the drive against the smog nuisance.

In New Jersey, the State Public Health Council decreed that beginning July 1, 1958, there may be no dumping of organic materials or combustibles and that only the landfill method may be permitted for these classifications.

Inside view: Here's what happens inside one of the new smokeless-odorless household gas incinerators when it burns up garbage and trash. Photo-diagram shows how refuse (1) is consumed by multi-flame torch burner. Additional heat and air are supplied at stages (2) and (3). There's nothing left to offend by the time products of combustion reach vent at upper right.

Members of the Gas Incinerator Division of GAMA manufacturing the smokeless-odorless incinerators who participated in the demonstration are:

Incinerator Division of Bowser, Inc., Cairo, Illinois
Calcinator Corporation, Bay City, Michigan
Caloric Appliance Corporation, Philadelphia
Locke Stove Company, Kansas City, Missouri
The Majestic Company, Inc., Huntington, Indiana
Martin Stamping and Stove Company, Huntsville, Alabama, and
Waste King Corporation, Los Angeles.

Models are made for use with both utility gas and liquefied petroleum gas.

Cuts Fire Hazard

Incinerator manufacturers are optimistic that many a home owner and home builder will take up the now relatively unfamiliar idea of burning garbage and trash right in the house. The big selling point is convenience—no garbage cans to wash or lug from place to place.

Other advantages include elimination of fire hazards through prompt disposal of paper and other combustibles, the fact that nothing is left to attract animal or insect pests, and the space saving aspects for home and yard, through elimination of garbage and trash storage, or makeshift burners.

True, the household incinerator owner still must dispose of non-combustibles—cans, bottles and such. But, it is contended, the remaining collection and dumping tasks can be less frequent and much less expensive. This, manufacturers state, is clearly demonstrated in cities such as Cleveland and Detroit where household gas incinerators already are in widespread use. Mounting costs of making collections, the shortage of suitable dumping grounds in many areas, and other aspects of what was called a growing "garbage crisis" were noted. * * *

How and Why It Was Developed:

Smokeless-Odorless Gas Incinerator Is New Product To Meet Growing Need

THE SMOKELESS-ODORLESS INCINERATOR is a new household appliance, scientifically designed and engineered to consume food wastes and trash without smoke or odor or any other objectionable by-products.

Since the word "incinerator" means many things to many people, it is important that these new gas appliances not be confused with public incineration plants, large apartment-type incinerators or the variety of makeshift backyard burners that many homeowners use.

The "smokeless-odorless" designation is an accurate description of this modern appliance — built to meet exacting requirements and specifications that insure efficient operation and satisfactory performance.

Requirements have been established by the Approval Requirements Committee of the American Gas Association and submitted to the American Standards Association for its approval.

To gain approval, each manufacturer's incinerator must pass a series of exhaustive and impartial tests at the laboratories of the American Gas Association in Cleveland. The requirements demand the efficient disposal of garbage and trash and the elimination of smoke, odor, and fly-ash nuisances. They also cover every detail of construction and performance that has a bearing on safety, efficiency or durability.

Seven manufacturers — all members of the Gas Incinerator Division of the Gas Appliance Manufacturers Association — already have obtained approval or have submitted appliances which are expected to be approved as smokeless-odorless incinerators in the near future. Each manufacturer has used his own talents, technical know-how and experience to produce an appliance that not only meets the basic smokeless-odorless requirements, but also offers additional features as well.

There is considerable difference, therefore, in exterior design and in interior construction. All, however, utilize flame to destroy smoke and odors — just as heat and flame consume refuse.

Many Problems Encountered and Solved

Intensive research over the years has brought many improvements in domestic gas incinerators, and permitted their satisfactory utilization in many areas. To produce models able to meet the new smokeless-odorless standards — and thus overcome what manufacturers believe to be the last barrier to much wider acceptance of household gas incinerators — extensive and costly research was required.

Because the objective is to burn up smoke and odors as well as refuse, the combustion process must be precisely controlled. Shape and location of burners and compartments, amount of air introduced and place of introduction, and limitation of updraft velocity to prevent unwanted movements of fly ash are among the problems that were solved.

The new smokeless-odorless domestic gas incinerators achieve outstanding performance without sacrifice of compactness or good looks, and without making any demand on the user that would take away from the sales appeal of simple, effortless, automatic disposal of refuse.

What the Incinerator Consumes

The smokeless-odorless domestic gas incinerator is designed to consume virtually all combustibles originating in the home — garbage, paper, rags, milk containers, cartons, string, sweepings, small pieces of wood, even heavy bones.

Situations vary widely, but it has been estimated the typical family accumulates daily three to three and one-half pounds of such combustible material, excluding paper for salvage. In terms of bulk, this refuse is of much more importance than would be an equal weight of non-combustibles.

Non-combustibles, such as metal cans and glass, should not be put in the incinerator.

Benefits to the Home Owner

There are outstanding benefits in convenience, health, safety, sanitation, and property improvement in use of the new incinerators.

It truly eliminates the garbage can, and eliminates garbage in the usual sense. The word "garbage" has been used here because of its familiarity, but the incinerator owner may be said to have a food waste problem, rather than a garbage problem. Food waste, disposed of easily and promptly, does not assume the disagreeable nature or the hazards that may prevail when it is stored for some time as garbage.

The incinerator owner has no garbage cans to clean or move about — the containers in which are stored non-combustibles for collection do not present the same problem. The garbage can is a problem whether stored indoors or outdoors; no arrangement to hide it can be truly satisfactory. It is a breeding place of flies and other insect pests, the target of roving cats and dogs, and sometimes even rats.

While suitable containers and frequent collections would tend to reduce such difficulties, there are inevitable cases of container breakage or spillage, and frequent collection delays.

Because so much of today's refuse load is paper — more than a pound daily for the average household in the country, and several times that in many homes — there is a constant fire hazard from such accumulated material. This is true whether trash is stored for collection, or for disposal in makeshift backyard burners, which add many hazards and nuisances.

Benefits to the Community

A garbage-free community can save a great deal of the important portion of the tax dollar that collections require, or, where the householder pays for monthly collections, enjoy a situation in which these payments are less than otherwise would be the case.

Modern health standards and sensitivities, along with ever-increasing urbanization, tend to more and more rule out old ways of disposal. There is reluctance to do garbage sorting, sometimes required.

Growth and prosperity of communities have made it more difficult to find dumping grounds, and has made the dumping grounds of the past less acceptable. Trucks must travel farther to reach them, through more traffic. Old dumping grounds are now filled up.

In a number of instances, upgraded standards of health, sanitation and air pollution control are forcing changes in refuse dumping arrangements.

Studies by GAMA members indicate that costs of conventional garbage and refuse collection, on the usual basis of collections several times a week seldom amount to less than 50 cents a week. Charges to householders of from $3 to $5 a month are not uncommon.

Greater use of domestic gas incinerators can greatly reduce cost of refuse collections in almost any community, and in many instances reduce their frequency. Such use can be an especially helpful factor where public incinerator buildings are unacceptable. Even when such public incineration facilities already are at hand, home models still bring about important savings in collection costs.

Using the Smokeless-Odorless Gas Incinerator

Disposing of garbage and trash with a smokeless-odorless incinerator is a two-step operation. First is the simple chore of loading the appliance and turning it on. Second, of course, is what happens inside the unit.

The user can operate the incinerator as often as necessary. Generally once a day would be enough. Wet garbage customarily is wrapped in newspaper — no other preparation is necessary.

A user may put all the charge (the material to be burned) into the incinerator at one time, or may elect to take advantage of its capacity — usually about one and a half bushels — to put refuse in the incinerator as it originates, to be burned later. A turn of a knob starts the controlled combustion process. The automatic timer turns the machine off. The fine gray ash, entirely inoffensive, should be emptied perhaps twice a month.

While, as noted, the various brands of smokeless-odorless incinerators differ somewhat in their design and features, they are all alike in this extreme ease of operation.

Little Ash Remains

Surprisingly, little ash remains from such an extensive volume of material burned. For example, a seven-pound assortment of garbage and paper, including bones, and taking up originally several cubic feet, is reduced to a mere handful of ash.

While not a complete fertilizer, the ash does have value for lawns and gardens.

Installing the Incinerator

Installation requirements for the smokeless-odorless domestic gas incinerator may be met readily in millions of American homes already equipped with masonry chimneys. Certain factory-built chimneys also can be employed.

Basements, utility rooms, kitchens, and rear porches are some of the places where installations are made. Planning services of many gas utilities will assist builders and home owners seeking to install domestic gas incinerators. * * *

FOR PILOT TUBING REPLACEMENTS . . .

Pre-formed Aluminum Tubing Solves Service Call Problem For Peoples Gas

Thaddeus A. Zamirowski
Supervisor of Service and Fitting,
North District Shop
The Peoples Gas Light and Coke Company
Chicago, Illinois

LIGHT, strong pre-cut aluminum tubing is being used successfully in Chicago by The Peoples Gas Light and Coke Company to replace clogged, flaking pilot tubings in gas water heaters, space heaters, and some central heating plants.

Paramount reason for service calls to adjust pilot lights of these gas-fired units is due to a lack of fuel being delivered to the pilot. This malfunction is caused primarily by internal scale in copper pilot tubing.

Internal flaking in copper tubing is due to oxidation and the corrosive effect of minute quantities of sulfur compounds in gas delivered to the pilot light. This flaking condition also may occur where LP or manufactured gas is used. Aluminum tubing is corrosive resistant and therefore is an excellent replacement. It has its limitations, one of which is its relative low melting point; therefore, its use is limited to ambient temperatures of around 350 F.

The author shows a preformed aluminum pilot tubing used to replace clogged copper pilot tubing on gas water heaters, space heaters, and on some central heating plants.

Idea Not Really "New"

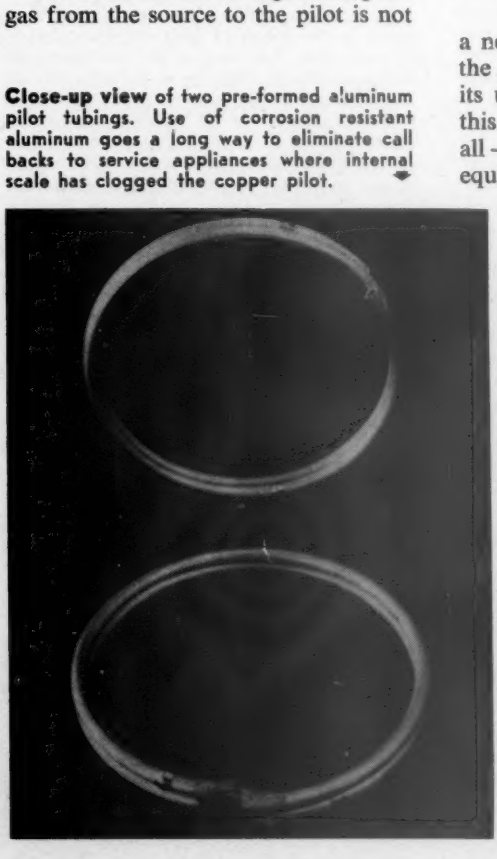
Use of aluminum tubing to bring the gas from the source to the pilot is not a new idea. In fact, several years ago the American Gas Association adopted its use as a standard requirement for this purpose. As a result most — if not all — units now being marketed are equipped with a pilot tubing made of either aluminum, steel, or copper coated with tin. All of these are resistant to oxidation and corrosion by sulfur compounds. Servicing pilot tubings on water heaters, space heating equipment, and some central heating plants is therefore diminishing, not only because of the change-over by appliance manufacturers, but also by the Peoples Gas' service program of changing copper pilot tubings immediately when found clogged.

Earlier, servicemen had been removing this internal scale when encountered in copper tubing by dismantling the source tubing and tapping and blowing through it until it was clean, then reinstalling it. They were occasionally called back to the customer's premise to repeat the operation. When aluminum tubing became available, the servicemen would, when encountering scale in copper tubing, clean it, and issue a ticket for replacing it on a subsequent call.

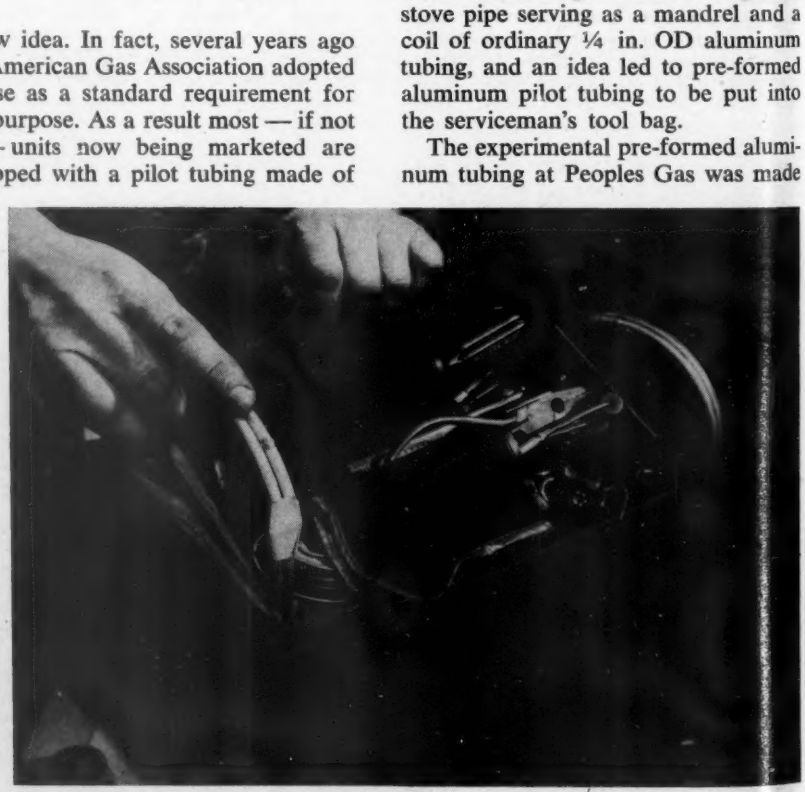
Tubing Sections Mass-Produced

Elimination of this second call became a challenge. Thus a length of stove pipe serving as a mandrel and a coil of ordinary ¼ in. OD aluminum tubing, and an idea led to pre-formed aluminum pilot tubing to be put into the serviceman's tool bag.

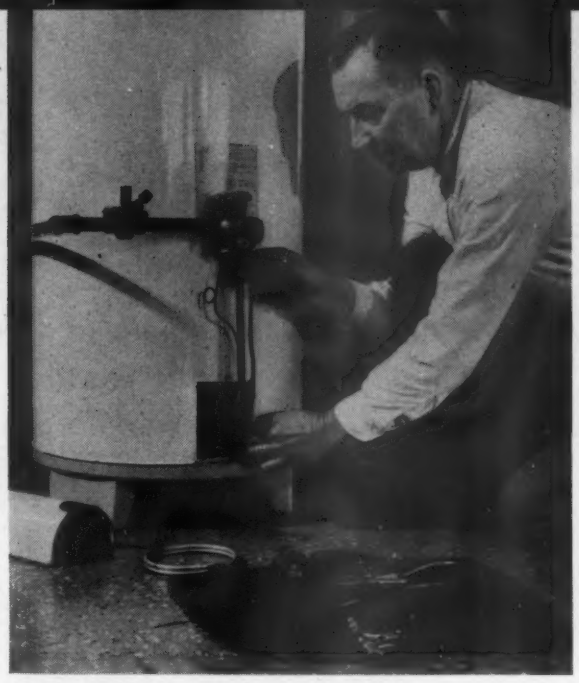
The experimental pre-formed aluminum tubing at Peoples Gas was made



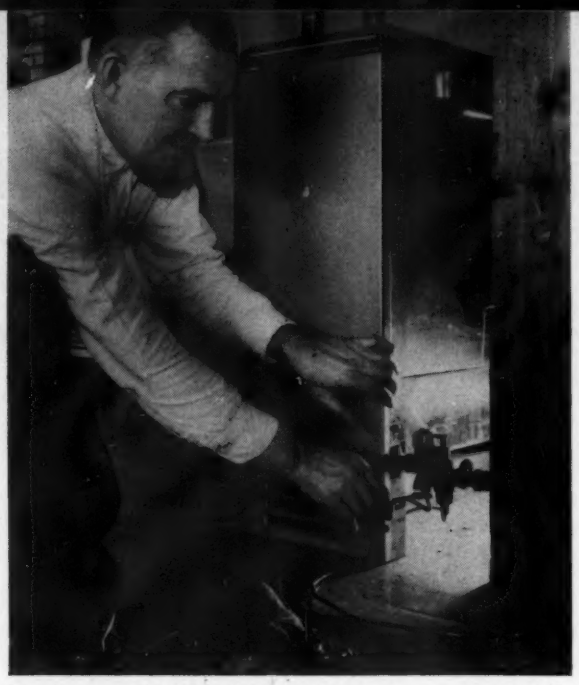
Close-up view of two pre-formed aluminum pilot tubings. Use of corrosion resistant aluminum goes a long way to eliminate call backs to service appliances where internal scale has clogged the copper pilot.



Each serviceman now carries as standard equipment two pre-formed aluminum pilot tubings that fit neatly into the tool bag.



Serviceman removes copper pilot tubing on water heater that has been clogged by internal scale in preparation for aluminum substitute (coil on floor).



Servicemap tightens the compression nut on one end of the aluminum tubing on a space heater after removing the clogged copper pilot tubing. The compression fittings on the appliance are re-used unless damaged.

by coiling a two foot length of ordinary tubing around the stove pipe, removing the coil, then cutting the coil to leave circular pre-formed sections. The tubings were fitted with compression fittings and ferrules.

Dropping the coil from shoulder height onto the floor proved its durability; it had no damaging effects. Stepping on the coil produced only a slight kink, but did not hamper its ability to furnish gas to the pilot. The test coils proved to be so durable they were adopted by management as standard equipment for the tool bag.

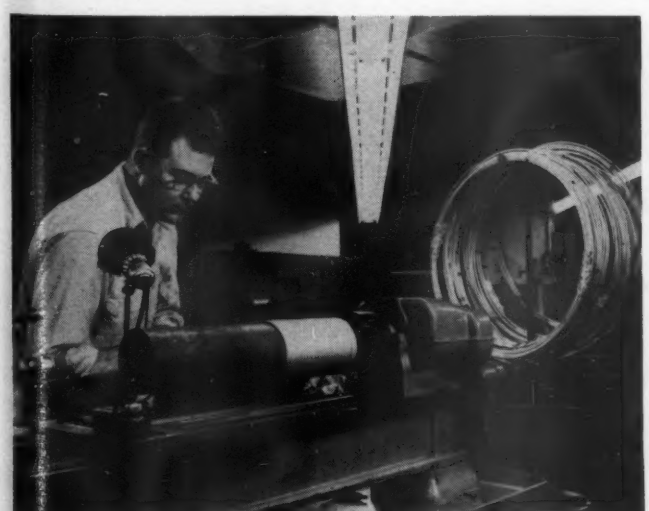
These standard aluminum pilot tubings are now mass-produced at the company's tool repair shop. A small piece of masking tape is placed over each end of the tubing to keep out foreign matter. The compression fittings on the appliance are re-used. Flaring is not needed on pilot tubings since compression fittings are used.

One Service Call Eliminated

Now, when a serviceman encounters a clogged copper pilot tubing on the customer's water heater, space heater, or central heating plant, instead of the time consuming procedure of disassembly, cleaning, and replacement with a second serviceman having to make a call back to change the tubing to aluminum at a later date, the entire operation is completed in one call. This change in service procedure also has resulted in a reduction in paperwork.

Use of aluminum tubing goes a long way in eliminating pilot malfunctions, the chief reason for service calls in these types of appliances, and lessens the possibility of having to service the appliance at a later date for a similar malfunction. Tests at Peoples Gas indicated that a 75 percent savings in call backs can be effected by the change in service procedure.

Intangible effects of the change are perhaps the hardest to measure; in the long run, probably the most important is that of improved customer relations. It has eliminated the length of time the serviceman must be in the customer's home and the length of time the appliance is inoperable. It creates the feeling of confidence in the customer that once the serviceman has adjusted the appliance it will once again give long and faithful service. * * *



A workman mass-produces the pre-formed pilot tubings by coil-winding standard 1/4-in. OD aluminum tubing at the company's tool repair shop.

Cutting every second turn on the coiled aluminum tubing produces the desired lengths of tubing which allow flexibility for the serviceman to adapt the coil to either the gas water heater, space heater, or central heating plant when replacing clogged copper pilot tubings.

Continuing Property Records:

Maurice E. Katz
Property Accountant
New Orleans Public Service, Inc.
New Orleans, Louisiana

they are valuable tools — simple and economical to maintain — that assure effective control of plant and property investment while consolidating statistical and cost data into one set of records

OBJECT of New Orleans Public Service's continuing property record is to provide maximum information with minimum clerical effort for such purposes as retirement processing, and collecting investment and statistical data for managerial and other requirements. In establishing the record, consideration was given to existing methods of field reporting, records maintained by the operating and engineering departments, the construction accounting system, and the types of continuing records used by other companies.

NOPS' operations are limited to the city of New Orleans, which greatly simplifies its plant accounting problems. New Orleans was approximately the fourth city in the nation to have gas service, the first mains being laid in 1835 by a predecessor company. It now has 163,000 gas customers, 1090 miles of mains, and a gas plant investment of approximately $26,000,000. From a record standpoint, gas property data have been maintained for many decades, some of the records being available back to 1853.

A construction accounting system, together with excellent field reporting, has greatly simplified the task of making cost analyses. An important feature of the accounting system is the use of a separate subaccount for each type and size of main and service.

Many years ago, with the assistance of the operating department, a system of subaccounts was put into effect, the object of which was automatically to assemble within a work order the material and labor costs by sizes and types of mains and services. Under this system, the account number is followed by the size of pipe and a letter to indicate the type of pipe: For example, 359-6B indicates a 6-in., high-pressure steel main.

One factor that makes use of the subaccount system possible is that separate crews perform main work, service work, and meter work. Since each crew reports its own work and costs separately, no confusion arises in cost segregation. It is no burden, therefore, to ask crews to indicate not only the work order number but also the account and subaccount on all material issues and time sheets.

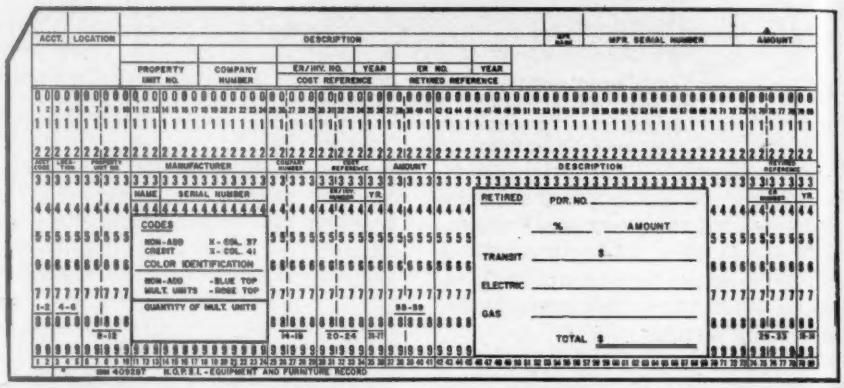


FIG. 1. Detailed records of equipment are kept on punched cards, as shown here. A card is made for every item of equipment.

Continuing Property Records

In general, there are two classes of property record units:

1. Identifiable and
2. Mass.

Identifiable units consist of such items as land, structures, general equipment, etc., the costs of which are identified individually in the record.

Mass units include such items as gas mains, services, meters, etc., the costs of which are summarized and identified in the record by annual totals, with annual average unit costs determined for each type and size.

Before describing the type of property record maintained, our unit coding system should be described in general terms. For mains, services, and meters, the system is designed to identify the various units by type and size: For example, 359.2060 is a 6-in. cast iron main, and 359.3060 is a 6-in. steel main.

The coding system for the punched card record of general equipment is more detailed. Here, for example, typewriters are coded by electric or manual, length of carriage, portable or standard. Code used for the punched card records is stated in a five digit field. The first two digits designate the unit (the principal noun is used as the basis for grouping items, such as typewriters, chairs, grinders, tampers-backfill); the other three digits are used to designate size or other pertinent characteristics within a particular group.

For example, the unit code 16623 equals

16 Comptometer Type Machine
6 10 Bank
2 Electric
3 Hours and Minutes

Property records fall into three sections:

1. Identifiable units maintained on punched tabulating cards,
2. Other identifiable units maintained manually, and
3. Mass-type units maintained manually.

A punched tabulating card record exists for all general plant equipment accounts, 372 through 379 except 378. Use of this form of record greatly facilitates making and printing of physical inventories, simplifies retirement processing, and enables us to furnish statistical and age data with minimum effort and at high speed. In connection with this record, a special form has been designed for the cost analysis of equipment authorizations, and from it the

NEW ORLEANS PUBLIC SERVICE INC. — EXHIBIT II

PROPERTY RECORD SUMMARY AT — DATE: MO. 12 DAY 31 YR. 56 — LOCATION — PAGE NO. 123

LOCATION	DESCRIPTION	MANUFACTURER Name	MANUFACTURER Serial No.	COMPANY NUMBER	PROPERTY UNIT NO.	PURCHASED Yr./Acct.	PURCHASED Yr.	ORIGINAL COST		YEAR RETIRED
	372 OFFICE FURNITURE/EQUIP									
99	ADD MACH 10 BNK EL TAPE ONLY	BUR	308503		2521	50020	52	358	32	
99	ADD MACH 10 KEY EL TAPE ONLY	REM	1099759		2821	50020	53	369	32	
99	CALCULATOR 10 BNK ELECTRIC	MAR	447616		10132	50020	54	860	32	
99	TYPEWRITER STD 16/18 IN PLATEN	UND	7207850		44140	50020	52	245	32	
99	TYPEWRITER EL 12 IN PLATEN	ROY	4808405		44220	50020	52	385	32	
99	CHAIR/SWVL W/ ARMS/WET UPH			20117	57241	50020	50	120	32	
99	DESK SECRETARY 60 IN WOOD			21852	61332	50020	54	180	32	
99	FILE LETTER 4 DRW			20633	67242	50020	51	98	32	
	373 TRANSPORTATION EQUIP									
30	TRUCK 3/4 TON INTL SERVICE			4900	78200	50490	55	2963	33	
30	CHASSIS AND CAB			4900	78201	50490	55	1588	33	
30	BODY			4900	78202	50490	55	1375	33	
30	2 WAY RADIO COST IN ACCT 378			4900	78203				33	
30	SEDAN 4 DOOR CHEVROLET MOD 1503			4901	32420	50490	56	2065	33	
	375 SHOP EQUIPMENT									
415	COMPRESSOR/AIR W/15HP EL MOTOR	INR			17410	50208	37	1182	35	
415	COMPRESSOR MOD ER1 7X5	INR	73614		17411	50208	37	685	35	
415	MOTOR 15HP MOD 5KF326B3	GEC	3913951		17412	50208	37	336	38	
415	FOUNDATION AND INST COST				17413	50208	37	130	35	
415	GRINDER/PED 8HP TYPE GPTA	GIN	142583		31200	50207	45	228	33	
	376 LABORATORY EQUIP									
402	GAUGE/RECORD/7 DAY/ 0 TO 12 IN	BRS	566237	71	30000	50207	53	120	36	
402	RECORDER/TEMP/24 HR CLOCK	BRS	107089		53400	50207	53	194	36	
416	POTENTIOMTR/INDIC PORT MOD126W2P	HNR	754210		49500	50207	54	219	38	
416	ELCOMETER/0 TO 10 MILLS RANGE	GDL	6756		84300	50207	55	72	36	
	377 TOOLS/WORK EQUIP									
499	BREAKER/PAVING MOD 85	THR	109411	74	8700	51064	54	385	37	
499	COMPRESSOR/TRACTAIR/BKFILL BLADE	LNR	493191	102	17400	50778	50	3900	37	
499	PUMP/4IN DIAPHRAGM/MUD HOG 404	MLW	85588	142	51067	51067	54	839	37	
499	WRENCH/IMPACT/PNEU 1/2 IN	IHR	681440	1	78600	50207	53	214	37	
	NOTE FOR ILLUSTRATION PURPOSES ONLY									

FIG. 2. All records on punched tabulating cards are listed on a master property record summary for each specific location.

cards are punched. A sample of the card we now use and an illustration of the form of listings prepared each year is shown in Fig. 1 and 2.

Identifiable units such as land, structures, submarine crossings, pressure regulating installations, etc., are recorded on ledger sheets. This type of form gives us greater flexibility in writing descriptions and details of construction costs, as illustrated by Fig. 3 for a typical structure.

Investment and quantity data for mass-type units are manually recorded on ledger sheets, an individual sheet being used for each type and size of main, service, meter, and regulator (see Fig. 4). On the ledger sheet, the following data are recorded for each property record unit for each year:

1. Quantities installed, retired, and year end balance;
2. Investment added, retired, and year end balance;
3. Year's average unit costs for installations and retirements as well as the average year end balance.

An auxiliary record is maintained to control the investment in each large commercial and industrial service, meter, and regulator installation (Fig. 5). A typical sheet describes the year of installation, job number, and additional information as to service description and types of meters and regulators. This record provides the basic data needed to determine the direct investment cost for any large customer (for special rate and other studies).

Maintenance of the continuing property record depends upon an adequate cost analysis system. The continuing property record exists principally for use in the retirement procedure. To illustrate the system and procedure in these areas, the main and meter installation accounts have been selected.

Main Additions

Each month the engineering department reports the numbers and titles of

EXHIBIT III

NEW ORLEANS PUBLIC SERVICE INC.

UNIT PROPERTY RECORD

045 — Distribution Structures and Improvements

DESCRIPTION OF PROPERTY UNIT: CENTRAL REGULATOR STATION
Single Story Brick Structure Consisting of Two Rooms
(1) 5'-11" x 31'-2½" x 12'-7½" and
(2) 19'-4" x 27'-1" x 11'-1½"
9" Reinforced Floor Slab on Piling; Composition Roof on 2" Bankboard over Precast Concrete Slabs

PROPERTY UNIT NUMBER 358.4010
LOCATION Magnolia St. bet. Perdido and Poydras
1 — MUNICIPAL DISTRICT — WARD

YEAR	REFERENCE	DESCRIPTION	ORIGINAL COST ADDITIONS	RETIREMENTS	BALANCE
1948	5575	Foundation:			
		Piling	344 00		
		Excavation	2015 00		
		Concrete	2387 00		
		Reinforcing	1217 00		
		Plumbing	877 00		9840 00
		Building Frame:			
		Concrete	1884 00		
		Reinforcing	754 00		
		Structural Steel	1173 00		
		Roof:			
		Stone & Concrete Deck	4370 00		
		Roofing & Sheet Metal	2074 00		
		Insulation Batt	427 00		
		Masonry & Brickwork	803 900		
		Plumbing	491 00		
		Electrical Work	414 00		
		Interoom System	140 00		
		Metal Doors	2124 00		
		Vents and Ducts	1634 00		23524 00
		Total Cost			33364 00
		(Typed for illustration only; routine entry made by hand in ink)			

Note: If greater quantity and cost detail is required, reference is made to the Cost Analysis of this job.

FIG. 3. Identifiable units — such as land, structures, regulator stations — are recorded on ledger sheets, allowing flexibility in describing the property and details of construction costs.

New Orleans Public Service Inc.
UNIT PROPERTY RECORD
GAS
Distribution Mains

6" WELDED WRAPPED STEEL MAIN, Cathodically Protected

EXHIBIT IV
359.30603
Constructed 1940 -
Feet

YEAR	NUMBER OF UNITS ADDED	RETIRED	BALANCE	ORIGINAL COST ADDITIONS	RETIREMENTS	BALANCE	UNIT COSTS ADDITIONS	RETIREMENTS	BALANCE
1940	24 413		24 413	53 168 44		53 168 44	2.18		2.18
1941	42 653		67 066	89 592 47		142 760 91	2.10		2.13
1942	16 596	48	83 614	40 170 43	106 64	182 826 70	2.42	2.18	2.19
1943	7 245	51	90 808	17 832 26	111 18	200 547 78	2.46	2.18	2.21
1944	8 925	184	99 549	21 698 37	403 12	221 775 03	2.42	2.18	2.23
1945	22 880		122 429	75 302 24		297 077 27	3.39		2.43
1946	33 351		155 780	113 665 66		410 742 93	3.42		2.64
1947	30 316	144	185 952	119 558 09	473 76	529 827 26	3.94	3.29	2.85
1948	48 948	548	234 352	203 381 96	1 943 75	731 265 47	4.16	3.55	3.12
1949	114 897	2 215	347 034	456 984 43	7 354 18	1 180 895 72	3.98	3.32	3.40
1950	110 118	66	457 086	451 973 35	233 64	1 632 635 43	4.10	3.54	3.57
1951	79 746	879	535 953	362 533 65	2 945 58	1 992 223 50	4.55	3.35	3.72
1952	59 588	749	594 792	268 560 59	2 779 94	2 257 804 15	4.50	3.71	3.80
1953	71 011	1 491	664 312	378 710 27	6 068 06	2 630 446 36	5.33	4.07	3.96
1954	77 679	3 011	738 980	454 172 83	12 216 63	3 072 402 54	5.85	4.06	4.16
1955	81 285	674	819 591	457 035 48	2 904 26	3 526 533 74	5.62	4.31	4.30

NOTE: (1) Typed for illustration only; routine entry made by hand in ink.
(2) Quantities and dollars retired are recorded and summarized by vintage year in an auxiliary record not illustrated here.

FIG. 4. Investment and quantity data for mass-type units — such as main installations — are manually recorded on ledger sheets, with individual sheets for each type and size of main, service, meter, and regulator.

New Orleans Public Service Inc.
UNIT PROPERTY RECORD
GAS DEPARTMENT
SPECIAL CUSTOMER INSTALLATIONS

Customer's Name
Customer's Address
LOCATION

EXHIBIT V
PROPERTY UNIT NUMBER
96, 8-25
DISTRICT

YEAR	M R NUMBER	W O NUMBER	DESCRIPTION	SERVICE 8381	METER INSTALLATION 8383	REGULATOR INSTALLATION 8386	TOTAL
1954	40004	9860	Contract Labor	389 40	-	-	389 40
			Material	442 13	584 70	276 30	1 303 13
			Labor	152 00	321 00	296 00	769 00
			Undistributed Costs	153 00	173 00	112 00	438 00
			Total	1 136 53	1 078 70	684 30	2 899 53
			(Typed for illustration only; routine entry made by hand in ink)				

ABOVE INVESTMENT DOES NOT INCLUDE COST OF METERS OR REGULATORS

NOPSI PROPERTY PHYSICAL DATA

REFERENCE	YEAR	SERVICES SIZE	SERVICES TYPE	SERVICES LENGTH	METERS BADGE	METERS MFG	METERS SIZE	ENCODER SERIAL	T P V MFG	T P V SERIAL	B P I MFG	B P I SERIAL	REGULATORS BADGE	REGULATORS TYPE	REGULATORS STYLE	REGULATORS SIZE	REGULATORS MFG	REGULATORS CONTROL
9860	1954	4"	WS	171'	142	Am.	500B				Am.	7959	664	HP	10L	3"	Fish	
					332	Am.	500B				Am.	7961	126	HP	P.L.	2"	Esco	
													276	HP	Pilot	1"	Bel.	

FIG. 5. Auxiliary records are maintained to control investment in each large commercial or industrial service-meter-regulator installation.

construction work orders that have been completed. Monthly, the construction department furnishes a report describing the quantities and locations of mains and services installed by type, size, and work order number. This is the equivalent of a completion report.

Upon receipt of the notices from the engineering and construction departments, an analysis is made of the costs of each completed construction work order. The fact that the company's stores accounting and material and supplies distribution to accounts is performed by means of a punched tabulating card system makes it convenient and economical for us to obtain a summary listing of the materials charged to each completed work order by accounts and subaccounts (each type and size of main and service).

The quantity of pipe charged to plant account is compared with the quantity originally estimated to do the work, and with the quantity reported by the construction department as physically installed. Experience has been that little variance usually exists. Reasons are obtained, however, for any substantial differences.

An analysis segregates costs by size and type of main installed. All principal materials such as pipe, valves, and special fittings are detailed from the material listings. Labor costs are detailed from the construction ledger, where they have already been segregated by types and sizes of main and service through the use of subaccounts.

Other costs such as taxes, transportation, and engineering are then prorated to each size and type of main installed. Unit costs are obtained by components of cost (labor, material, total), and are then compared with the costs of other completed work orders during the current year, and reasons are obtained for any large variances.

At the end of the year a grand summary is made of all completed main work orders for quantity and investment added to plant account by type and size. The total of the completed work orders for each year is then posted to the continuing property record by size and type.

A similar procedure is used for analyzing the service account.

Main Retirements

A location record is maintained by the company's engineering department. A separate card for each block in the city shows the physical location, size, type, and year of installation of the mains in that block. Although this record locates all gas mains in the system, the continuity of the vintage data begins with 1905. To determine the vintage of mains installed prior to that

359

MAINS – DISTRIBUTION

NEW ORLEANS PUBLIC SERVICE INC.

VINTAGE RECORD OF PLANT IN SERVICE

EXHIBIT VI

ACCOUNT No. 359 PERIOD

YEAR		(HYPOTHETICAL) TOTAL PLANT IN SERVICE	PLACED IN SERVICE IN YEAR/PERIOD											
			PRIOR TO 1/1/54	1954		1955	1956	1957	1958	1959	1960	1961	1962
			STRAIGHT LINE	STRAIGHT LINE	S.Y.D.	S.Y.D.	S.Y.D.	S.Y.D.	S.Y.D.	S.Y.D.	S.Y.D.	S.Y.D.	S.Y.D.
DEC. 31 1953	PLANT IN SERVICE	4,004,000	4,004,000										
1954	ADDITIONS	104,000		34,000	70,000								
	RETIREMENTS	24,000	18,800	200									
	BALANCE DEC. 31	4,084,000	3,986,200	33800	70,000								
1955	ADDITIONS	80,000				80,000							
	RETIREMENTS	15,000	14,000	400	300	300							
	BALANCE DEC. 31	4,149,000	3,972,200	33400	69700	79700							
1956	ADDITIONS	150,000					150,000						
	RETIREMENTS	50,000	46,000	1,000	500	500							
	BALANCE DEC. 31	4,249,000	3,926,200	32400	69200	79200	150,000						
1957	ADDITIONS	90,000						90,000					
	RETIREMENTS	10,000	9,200	200	200	200	100	100					
	BALANCE DEC. 31	4,329,000	3,909,000	32,200	69000	79000	149900	89900					
1958	ADDITIONS	100,000							100,000				
	RETIREMENTS	15,000	14400		300	100	100	100					
	BALANCE DEC. 31	4,414,000	3,894,600	32200	68700	78900	149800	89800	100,000				
1959	ADDITIONS	60,000								60,000			
	RETIREMENTS	6000	5300	200	100	100	100	200					
	BALANCE DEC. 31	4,464,000	3,889,300	32,000	68600	78800	149700	89600	100,000	60,000			
1960	ADDITIONS												
	RETIREMENTS												
	BALANCE DEC. 31												
1961	ADDITIONS												
	RETIREMENTS												
	BALANCE DEC. 31												
1962	ADDITIONS												
	RETIREMENTS												
	BALANCE DEC. 31												

Note: Prepared for illustration purposes only.
The balances at December 31, 1962 will be carried forward to a new base sheet and fly sheets will be used to record years after 1962.
All January 1, 1954 work in progress was placed in service by the end of 1954.

FIG. 6. Vintage record — used to support plant balance for income tax purposes — is posted annually with additions and retirements. Hypothetical case is shown here.

year, other records exist that permit actual dating of mains back to 1853. A small residue of mains still in service was installed during the period 1835 to 1853.

All retirement work authorizations originate in the engineering department and show the original date of installation in addition to the location, type, size, and length of pipe to be removed; therefore, all property disposal reports that we receive from the operating department for processing have the necessary information for dating and pricing retirements.

Mains installed from 1922 to date are priced at the year's applicable annual average unit cost, and mains installed prior to 1922 are priced on the basis of five-year band averages.

A special retirement pricing form is used for processing property disposal reports, and is designed for pricing by vintage year or period of original installation by property unit. At the end of the year a grand summary of all retirements is made by quantity and cost for each property unit for posting to the continuing property record. In addition, the form is designed for summarizing for each property unit the quantity and cost retired from each year or period of installation. On the basis of this record, a continuing record of the quantity and investment remaining in service for each year or period of installation is maintained.

Meter Installations — Additions

The quantity of meter installations added each month is reported by the construction department as part of its monthly summary of meter activity. This report gives by type and size the number of meter sets installed and removed.

Meter installation material is charged to plant account based upon a standard unit cost per type and size of meter. All material used by the meter crew is initially charged to a maintenance account. Each month this account is credited and plant charged, based upon the standard unit cost applied to the quantity of meter sets installed, as shown in the construction department's monthly report of meter activity. Standard unit cost is reviewed periodically to reflect current unit material prices.

Meter installation labor is charged directly to plant account from the meter crews' time sheets. Allocation of actual labor costs to meters by size and type is made on the basis of estimated unit labor costs developed for each type and size.

Meter Installations — Retirements

The quantity of meter installations to be retired is reported monthly by the construction department. Meter installations are priced, for retirement purposes, at the balance average at 1/1/50; however, all service retirements that are dated as installed after 12/31/53 are examined to determine if any represent abandonments of locations. An equivalent quantity of meter installation retirements is dated "after 12/31/53."

Vintage Record

NOPS is now in the process of establishing an auxiliary plant dollar vintage record, to be used primarily to support, for income tax purposes, the plant balance at the end of each year starting with 12/31/53, classified as to property constructed prior to 1/1/54 and by vintage year thereafter. Additions and retirements will be posted annually, as indicated in Fig. 6.

Conclusion

This property record system is a very valuable tool in the administration of the plant accounting function. It is simple, easy, and economical to maintain. Its existence assures management of effective control over the investment in plant and property. In addition to the exercise of control and proof of physical property and investment, there has been consolidated into one set of records the wealth of statistical and cost data frequently needed in managerial and other studies.

Acknowledgment

This article prepared from a presentation made at the Southern Gas Association Annual Conference, New Orleans, Louisiana, 1957. * * *

CORROSION—What Causes It and How It Happens

Part 2

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CORROSION CELLS

In corrosion processes there is an anode or anodic area that corrodes, an electrolyte, a cathode which is not corroded and a return circuit. Practically never in our corrosion problems are these elements arranged in a neat cell. Usually, corrosion cells are so integral a part of the structure that we are likely to fail to recognize them. But regardless of the appearance or shape of the cell, it always must have the elements: Anode, electrolyte, cathode, and return circuit. A copper pipe joined to an iron pipe with water in the pipe supplies all the requirements of a corrosion cell; so does a piece of slag embedded in a piece of steel if the slag and steel are both exposed to moisture.

There Are Two Types of Corrosion Cells

Referring again to the essential elements of corrosion cells: An anode, and electrolyte (commonly called the environment), a cathode and a return circuit, in addition we must have one or both of the following conditions in order to have a voltage difference between the electrodes: (1) The electrodes must be dissimilar, (2) the environments must be dissimilar at the two electrodes. Either condition alone will produce a voltage; sometimes the two work together to produce a higher voltage than either would alone; sometimes the two are at odds with each other and the voltage is less than it would be for either alone. We will examine these conditions a little more fully.

Corrosion Caused by Dissimilarity of Electrodes

1. **Two dissimilar metals in contact.** When the materials serving as electrodes are quite dissimilar, as is the case with two metals widely separated in the electromotive series, they produce considerable voltage and corrosion can be rapid.

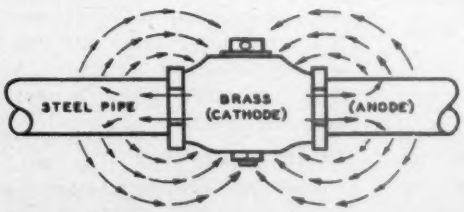

FIG. 4. Brass shut-off valve is cathodic to steel pipe; this promotes corrosion of steel pipe.

One illustration has already been given, that of a copper pipe connected to an iron pipe carrying ordinary tap water. The steel pipe is the anode and corrodes, the copper pipe is the cathode and the water in the pipe is the electrolyte. If this pipe is underground, the soil moisture will also serve as electrolyte and the steel pipe will corrode outside as well as inside. Another example is a brass shut-off valve in a steel service line as shown in Fig. 4. The brass valve is cathodic, the steel pipe, anodic and it will corrode.

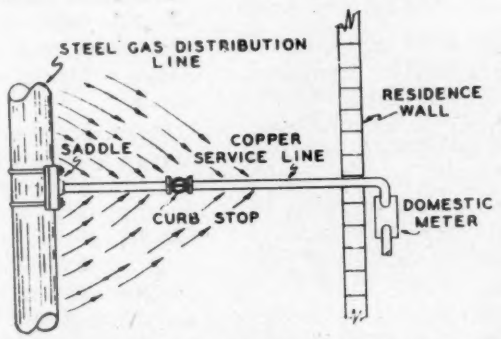

FIG. 5. Copper service line is cathodic to steel distribution line; promoting corrosion of steel line.

Another example is shown in Fig. 5, where a copper gas service line is connected to a steel distribution line. In such a case, the copper line is actually being protected at the expense of the steel.

If the metals are close together in the electromotive series they develop a smaller voltage and in some cases the voltage may not be sufficient to produce a current and there will be no corrosion. As a rule, we do not like to join two metals if they are a considerable distance apart in the electromotive series. The metals in the electromotive series have been grouped to help us in making safe selections. This grouping is shown in Table 3.

Metals in any group may, as a rule, be connected with safety, as regards corrosion, to any other metal in the same group. The two metals will produce a voltage but not enough to promote any appreciable galvanic corrosion. If, however, a metal in one group is

TABLE 3. Galvanic Series of Metals and Alloys.

Corroded end (anodic, or least noble)

Magnesium
Magnesium alloys
↓
Zinc
↓
Aluminum 2S
↓
Cadmium
↓
Aluminum 17ST
↓
Steel or iron
Cast iron
↓
Chromium-iron (active)
↓
Ni-Resist
↓
18-8 Cr-Ni-Fe (active)
18-8-3 Cr-Ni-Mo-Fe (active)
↓
Hastelloy C
↓
Lead-tin solders
Lead
Tin
↓
Nickel (active)
↓
Inconel (active)
↓
Hastelloy A
Hastelloy B
↓
Brasses
Copper
Bronzes
Copper-nickel alloys
Titanium
Monel
↓
Silver solder
↓
Nickel (passive)
Inconel (passive)
↓
Chromium-iron (passive)
18-8 Cr-Ni-Fe (passive)
18-8-3 Cr-Ni-Mo-Fe (passive)
↓
Silver
↓
Graphite

Protected end (cathodic, or most noble)

connected to any metal in another group there will very likely be galvanic corrosion, and the farther the groups are apart, the greater will be the corrosion tendency.

Unfortunately, in many industrial combinations of metals, iron or steel is the anode and will corrode. Table 4 gives a clue to anodic-cathodic combinations. Note that only in the last four combinations listed is the iron cathodic, and therefore protected against corrosion.

Sometimes a new section of pipe is welded into an old line as shown in Fig. 6. The new pipe always becomes anodic and will corrode.

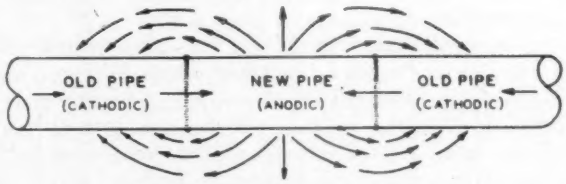

FIG. 6. When section of new pipe is welded to old pipe, new section invariably will be anodic.

Keep in mind that the above anodic-cathodic combinations are not rigid. A change in environment can upset the order. For instance, at near boiling temperatures the zinc-iron combination can become reversed.

Mill scale becomes imbedded in the surface of new pipe during the manufacturing process. The mill scale acts as if it were a dissimilar metal from the pipe wall. Table 4 tells us that iron is anodic to mill scale. Therefore, current will flow from the iron (anode) through moisture in the ground onto the scale and return along the pipe metal.

2. **Different thermal treatment.** If two pieces of otherwise similar steel are connected, but one is tempered, the other annealed, the tempered steel will be anodic to the annealed steel.

3. **Scratches or abrasion.** If a piece of metal is scratched or abraded, the scratched or abraded area will be anodic to the surrounding area.

4. **Differential strain.** A strained area is usually anodic to an unstrained area. When the jaws of a pipe wrench bite into the pipe surface, this strained area will rust because it is anodic to the surrounding area. The head and point of a nail are anodic to the shank.

There are other conditions in the metal surfaces that cause corrosion and, although some may not be of much importance in underground corrosion, they are listed here to make the story more complete.

5. **Differential grain and matrix composition.** In many alloys there are crystals of one composition surrounded by a matrix of another composition and the two phases have a potential difference, but no general rule can be established. In the case of $CuAl_2$ crystals in a Cu-Al alloy matrix, the matrix is anodic to the crystals, but Mg_8Al_8 crystals are anodic to the surrounding Mg-Al alloy matrix, whereas in the case of $MnAl_6$ crystals in a Mn-Al alloy matrix there is no potential difference between the two phases.

6. **Grain boundaries.** In all metals there are grains with grain boundaries between them. Usually the grain boundary is anodic to the main part of the grain.

TABLE 4. Corrosion Tendencies. Voltaic Couples

In corrosion processes the anodic area wastes away, i.e., it corrodes. The cathodic area remains unharmed.

ANODIC	CATHODIC
Steel	Cementite
Cast Iron	Graphite flakes
Iron	Sulfide of iron
Iron	Sulfur
Iron	Lead
Iron	Mill scale
Iron	Brass
Iron	Copper
Iron	Monel metal
Iron	Nickel
Iron	Tin
Iron (non-aerated)	Iron (aerated)
Iron	Hydrogen
Iron (moving electrolyte)	Iron (stationary electrolyte)
Strained metal	Unstrained metal
Aluminum	Iron
Cadmium	Iron
Zinc	Iron
Magnesium	Iron

7. **Differential grain size.** Metal grains are never of uniform size; usually the smaller grains are anodic to the larger ones.

8. **Rough surfaces.** In cases where a rough metal surface is adjacent to a smoother surface, the rougher surface is anodic to the smoother one.

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9. **Differential curvature.** If a metal has curved surfaces, the more highly convex surface is anodic to the less convex surface.

These examples are not the only ones of cases where differences in two materials cause corrosion, but they are the more important ones.

Corrosion Caused by Dissimilarity of Electrolytes

In some cases the surface may be uniform in all respects so that it, in itself, presents no anodic and cathodic areas (although this is rare) yet differences in the electrolyte in contact with the metal can cause corrosion.

1. **Differential composition of the electrolyte.** Spilled battery acid seeping down to a section of underground pipe will put one part of a pipe in contact with acid, but a short distance away there may be neutral ground water. This will cause a difference in potential between the two pipe areas and will cause corrosion. In the back fill of an underground pipe old ashes may be thrown over the pipe in one place, but nearby there may be "clean" dirt. This causes a difference in the composition of the soil moisture causing corrosion of the pipe. One section of pipeline may be laid through sandy loam, while a short distance away, the pipe is buried in a clay soil. In the Appalachian area the section of pipe buried in clay soils is almost without exception anodic to pipe sections buried in loam.

2. **Differential concentration of the electrolyte.** The same kind of electrolyte may have different concentrations in contact with a structure. The area of metal in contact with the more dilute solution will be anodic and will corrode.

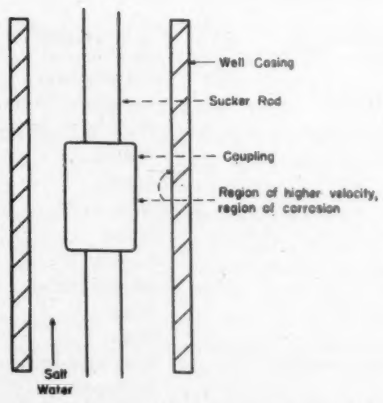

FIG. 7. Metal in region of higher liquid velocity is anodic.

3. **Differential oxygen concentration.** Oxygen concentration around electrodes has a strong influence on corrosion. The anodic area is the one having the lower oxygen concentration.

4. **Temperature differential.** If the temperature of one area of a structure differs from that of another, the region of higher temperature will be anodic to the cooler area.

5. **Differential motion of the electrolyte.** If a structure is subjected to varying velocities of the electrolyte, the area of higher velocity will be anodic, as illustrated in Fig. 7.

6. **Differential illumination.** Of no interest in corrosion of underground structures, yet of value in general corrosion studies, is the effect of differential illumination. The darker region will be anodic to the brighter areas.

We have now discussed two groups of conditions that cause corrosion, one in which the electrodes are different, the other in which the environment is different. Fifteen cases have been presented that can produce voltaic cells and therefore, can cause corrosion, and although these represent the more important cases, they probably represent only half of the possible ones. A number of these combinations can be at work at the same time; some of them may work together and accelerate corrosion, or fortunately they may oppose each other and reduce or even eliminate corrosion.

Why Do Single Metals Corrode?

In this discussion of corrosion cells we have mentioned two electrodes, one a corroding anode, the other a protected cathode. Why, then, will a single metal corrode if all parts are in a uniform environment?

This is because practically all metals have numerous little anodic cathodic areas that are parts of local couples. When moisture is present, corrosion sets in. These areas may be very small, even microscopic in size. The difference in these areas is often due to segregation of impurities in the metal, or to attached pieces of mill scale, or to strains introduced accidentally or in the manufacturing process.

In much of the corrosion, one small area of the metal may be anodic to one adjacent area and cathodic to another. Furthermore, there may be a continual shifting of potentials so that areas change from anodic to cathodic and back again. This is believed to explain why a metal will corrode fairly uniformly. On the other hand, an area may be anodic and remain so throughout the corrosion process. Such an area continues to waste away and eventually may put a hole through the structure.

The question is sometimes raised, if a metal is absolutely pure, so that there is no segregation, and if there are no strains, will the metal still corrode? Pure metals can corrode, but if there is no segregation of impurities and there are no strains, some causes of corrosion are removed and such metals may suffer only very slow corrosion or none at all.

It must be kept in mind that the purest metal still has grains and grain boundaries, whose influence on corrosion was mentioned above. An alloy may have different crystalline phases, which are a natural part of the alloy and therefore are not impurities, and these crystals may have different potentials.

Furthermore, "pure" steel consists of ferrite and cementite crystals which have different potentials; cast iron contains iron crystals and graphite flakes. Even if the metal has only one species of crystals, as pure iron, various crystalline faces will have different potentials.

There is, therefore, little chance of having any metal free of anodic and cathodic areas. Fortunately, in some cases potentials developed between these areas are not enough to cause a current to flow and there is no corrosion. This brings us to a new term, "polarization" to be discussed in Part 3.

Part 3 will appear in the next issue of *American Gas Journal.*

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Gas Calorimetry

Part 4 — Comparisons, Calculations, and Corrections

CLASSIFICATION OF INSTRUMENTS to determine heating value based on the quantity actually measured in the equipment has been discussed previously. An attempt also was made to describe the fundamental principle of operation of the best known or most widely used instruments in each classification. To summarize the information, two illustrations have been prepared. In Fig. 13, the response time of some typical continuous automatic recording calorimeters is shown. Data is also included on an instrument similar in principle to the thermeter, which is used only as a controller. Fig. 14 shows a chart that attempts to summarize many of the important characteristics of each instrument.

Importance of gas heating value determination to the gas industry emphasizes the necessity of accurate measurement of this quantity. In general, it would seem the most accurate method of measurement should follow closely the definition of total heating value. Previous review of types of gas calorimeters shows that two of the most accurate instruments are the manual water flow type and the Cutler-Hammer recording type. Both instruments measure total heating value essentially in the way outlined by the definition of the term.

Essential elements in the accurate determination of heating value of a gas are:

1. Securing representative gas sample without excessive time lag.
2. Insuring proper flow of the sample to the calorimeter burner.
3. Producing correct flow of combustion air.
4. Insuring proper combustion.
5. Determining quantity of gas burned.
6. Determining quantity and temperature rise of heat absorbing material.
7. Insuring uniform flow of heat absorbing material to heat exchanger in a manner to cool the products of combustion to essentially the initial temperature of the combustion air and gas sample.
8. Determining heat losses in the process and equipment.
9. Evaluating quantitatively the effect of test conditions that do not agree with the definition of total heating value.
10. Calculation of observed heating value and applying proper corrections to secure the total heating value.

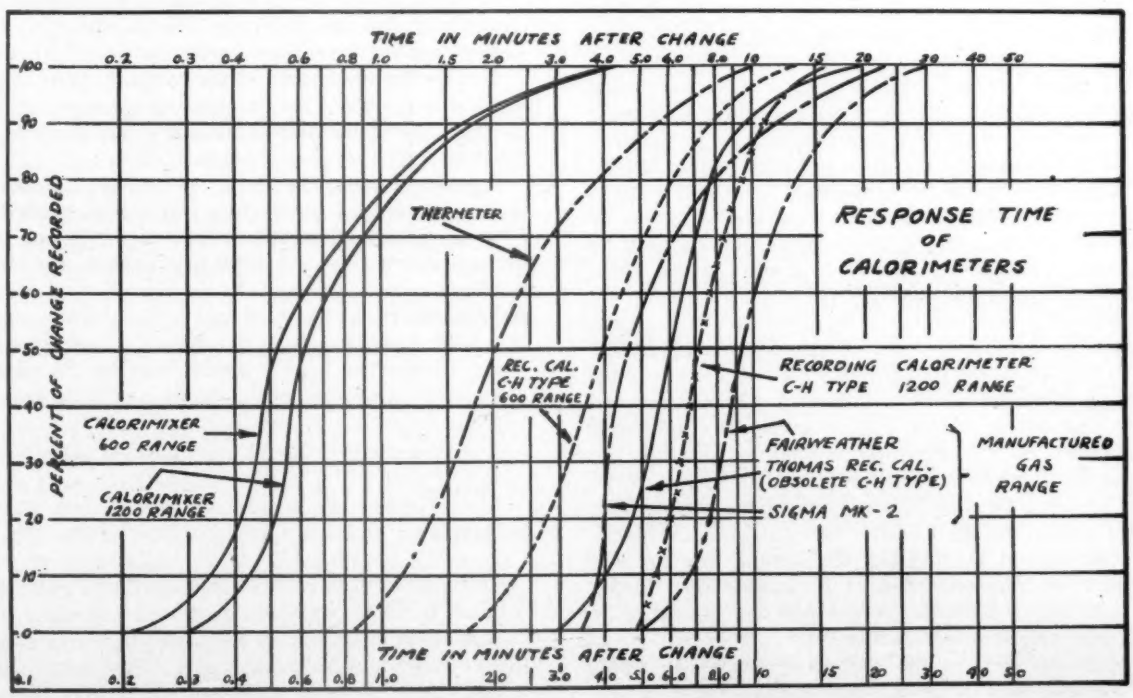
TIME IN MINUTES AFTER CHANGE
PERCENT OF CHANGE RECORDED
THERMETER
RESPONSE TIME OF CALORIMETERS
REC. CAL. C-H TYPE 600 RANGE
RECORDING CALORIMETER C-H TYPE 1200 RANGE
CALORIMIXER 600 RANGE
CALORIMIXER 1200 RANGE
FAIRWEATHER THOMAS REC. CAL. (OBSOLETE C-H TYPE)
SIGMA MK-2
MANUFACTURED GAS RANGE
TIME IN MINUTES AFTER CHANGE

FIG. 13. Time lag of calorimeters. (Does not include sample line lag.)

FIG. 14. Chart of gas calorimeter characteristics.

Type of Calorimeter	Total Heating Value Type	Net Heating Value Type	(Results in Total Heating Value) Inferential Type	Manual	Spot Sample	Continuous Sample	Automatic Recording	Reliability Over Period of Operation	Operating Skill Required	Calibration Requires Tests of Individual Parts of System	Calibration by Overall Tests	Calibration by Comparison with Other Calorimeters or by std. Gas Sample	Application	Time Lag of Instrument or Time for a Determination	Accuracy	Calculations Required
Water Flow Calorimeter (American—Precision)	X			X	X			E	C	X			Gen.	L	E	X
Fairweather—Water Flow Type	X					X	X	V.G.	C	X			Gen.	L	V.G.	
Cutler-Hammer Type—Air as Heat Absorbing Medium	X					X	X	E	A		X		Gen.	A	E	
Bomb—Combustion at Constant Volume	X			X	X				M	X			Lab.	VL	E	X
Thermeter—Air as Heat Absorbing Medium		X				X	X	V.G.	A		X	X	L. Gen.	S	G	
Sigma—Expansion of a Material		X				X	X	G	A			X	L. Gen. V. Lim.	A	G	
Caloroptic—Flame Appearance			X	X		X		F	N			X	Gen.	S	F	
Gas Analysis—Absorption Method			X	X	X				C	X			Lab.	VL	F	X
Mass Spectrometer			X	X	X				M	X			Lab.	VL	E	X
Specific Gravity			X			X	X		A				V. Lim.	S	F	X

E. = Excellent F. = Fair V.L. = Very Long M. = Very Much L. Gen. = Limited General
V.G. = Very Good C. = Considerable S. = Short N. = None Lab. = Laboratory
G. = Good A. = Average Gen. = General L. = Long

Gas Sample Line

The sample line that brings the gas sample to the calorimeter is frequently not given sufficient thought in making the installation. No matter how accurately and carefully the determination of heating value is made, if the sample brought to the calorimeter is not representative of gas in the main line, the determination is of little value. Although a rapidly changing heating value introduces complications in the use of the manual flow calorimeter, it is important to observe all of the following points in making the sample line installation:

It is essential that the sample tap be located at a point in the system where a representative sample will be secured. This means the tap should be located on an active line avoiding dead ends in which little or no flow takes place at certain times. Where two or more gases are involved in a line which is being sampled, adequate mixing must exist under all conditions of flow. Proper mixing can usually be secured by baffle plates, orifice plates, and pipe bends. Turbulence of flowing gases is necessary to insure mixing. Schemes involving tangential admission of gases of different gravities into cylindrical chambers should be avoided. Caution is required to avoid "cream separator" effects in the mixing process.

In taking samples from high-pressure lines, care should be exercised to avoid temperature conditions following pressure reductions which can cause condensation of one of the constituents. Multistage pressure reductions, steam tracing of sample lines and regulators, or special sample regulators, in which the reducing valve is actually surrounded by the main line gas, can be used. These precautions are particularly important on LPG-air sample lines. Troubles can be caused by locating the sample line so it is subject to transient changes in temperature if the sample includes constituents which can condense or vaporize under these changes.

Materials used in the sample line can also result in a loss or gain of certain constituents. Flexible tubing materials can absorb constituents of a gas. If the tubing is later used on another gas, these constituents can be given up to the gas sample. For this reason, in making a hydrogen test on the recording calorimeter using hydrone, it is recommended tubing be used for this purpose only in order to avoid contamination. Sometimes pipe joint compounds contain volative materials that can cause temporary errors in heating value determinations.

It is always desirable to obtain a record of heating value that is an actual picture of conditions existing in the line. Thus, sample line time lag should be kept as small as possible. This will involve one or more of the following:

1. Locating calorimeter close to sample point.
2. Using small size pipe or tubing for sample line.
3. Operating sample line at low pressure.
4. Providing additional purge burner.
5. Circulating sample to low-pressure point or providing sample line circulating pump.

The following example illustrates this point as applied to a recording calorimeter.

Assume installation is a recording calorimeter measuring natural gas heating value. Line pressure is 50 psig. Calorimeter range is 900 to 1200 Btu. Natural gas heating value is 1000 Btu. Sample line length is 100 ft.

A. Assume ½-in. standard pipe is used for the sample line with a sample line regulator to reduce pressure from 50 psig to 1 psig directly at the calorimeter connection. Capacity of ½-in. pipe, 100 ft long is:

$$\frac{(0.622)^2\,\pi}{(12)^2\,4} \times 100 = 0.212 \text{ cu ft free capacity}$$

at 50 psig,

$$\text{capacity} = 0.212 \times \frac{50 + 14.7}{14.7} = 0.93 \text{ cu ft.}$$

The recording calorimeter uses 1200 Btu per hour. Thus, gas consumption is

$$\frac{1200}{1000} = 1.2 \text{ cu ft/hr}$$

$$\text{Therefore, time lag} = \frac{0.93}{1.2} \times 60 = 46.5 \text{ minutes.}$$

B. By moving the sample line regulator close to the tap on the main, we can assume the 100 ft of sample line at 1 psig

$$\text{capacity} = 0.212 \times \frac{1 + 14.7}{14.7} = 0.226 \text{ cu ft}$$

$$\text{Therefore, time lag} = \frac{0.226}{1.2} \times 60 = 11.3 \text{ minutes}$$

C. Same as "**B**", using ⅛-in. standard pipe:

$$\text{Pipe capacity} = \frac{(0.269)^2 \pi}{(12)^2 4} \times 100 = 0.0394 \text{ cu ft free.}$$

At 1 psig,

$$\text{capacity} = 0.0394 \times \frac{1 + 14.7}{14.7} = 0.042 \text{ cu ft.}$$

$$\text{Therefore, time lag} = \frac{0.042}{1.2} \times 60 = 2.1 \text{ minutes}$$

Flow of Gas Sample to Burner

In the manual flow calorimeter, flow of gas to the burner is controlled by use of one or more pressure regulators and restrictions in the line. The number of regulators depends upon sample line pressure. One will be located ahead of the wet test meter. Location of the final regulator is preferred because it eliminates possible variation in line capacity after the meter, and will sometimes disclose a bad meter condition. A fluctuating temperature rise in the calorimeter can be caused by trouble in the meter.

Major portion of the gas pressure drop in the system to the calorimeter should be taken at the burner nozzle. Only minor changes in rate of sample flow should be secured by adjusting the cock ahead of this nozzle. Since potential heat flow factors (heating value divided by the square root of the specific gravity) vary widely for the gases that may be tested, and since operating requirements of the water flow calorimeter require essentially constant rate of heat input and primary air requirement, it may be necessary to change the burner nozzle size to obtain proper adjustment of the burner for primary air.

The established rate of gas flow to the burner is important since correction factors applied to the test results are based on an accepted rate of heat input. It is assumed that the rate does not exceed capacity of either the gas meter or combustion chamber of the calorimeter, and that the rate of combustion air flow is set at the value used in calculating the humidity correction.

A table included in the ASTM publication D900-55 gives the time in seconds for one revolution of the 0.1 cu ft wet meter corresponding to a rate of 3000 Btu per hour for various heating values. Gases having a heating value below 300 Btu require a reduced rate that must be used to keep the flow below 10 cu ft per hour.

In the recording calorimeter, two burners are involved — one, the purge or bleeder burner, and the other, the main burner. Total gas consumption is determined by inlet orifice (see Fig. 7) size and the pressure applied to it. Purpose of the pressure reducing inlet orifice and bleeder burner is to establish atmospheric pressure on the inlet of the gas meter. Orifice size is determined by the range of the instrument, and to some extent, by the type of bleeder burner. Generally, the size will vary from about a No. 78 drill for a 3600 range instrument to a No. 60 drill for a 150 range. The important point to remember is that only enough gas should be supplied to the bleeder burner to keep it burning. A large flame, particularly on gases of high specific gravity, can result in a false pressure on the gas meter.

Delivery of gas to the main burner is determined by capacity of the gas meter which is driven by an electric motor through a gear train. Two gears of the train are changed to vary delivery rate. This calorimeter is designed so there is a fixed Btu delivery rate to the burner to produce full scale reading. Thus, the two gears which are changed ("A" run gear and "B" run gear) are selected on the basis that:

$$\frac{A}{B} 300 = \text{Full Scale.}$$

Where A = Number of teeth in driving gear.
B = Number of teeth in driven gear.

Correct Flow of Combustion Air

For satisfactory combustion and to permit use of calculated humidity corrections and inlet water-room temperature difference correction for the manual water flow calorimeter, the combustion air rate must be set at a value that will give 40 ± 5 percent excess air. Combustion data show most gases require from 0.75 to 0.98 standard cu ft of air per 100 Btu. This corresponds to 0.525 to 0.885 cu ft of air per minute to the calorimeter. (Gas rate 3000 Btu per hour and 40 percent excess air.) The required air can be induced by natural draft. In certain cases, it has been necessary to close the damper in the exhaust completely, and restrict openings in the damper to establish the correct flow.

Accurate determinations of excess air are difficult. A complete slow combustion or explosion analysis of the gas being tested is required. From this, volume of flue gases and air requirements for theoretically complete combustion may be calculated. Then, from these data, the percentage of excess air in the flue gases is calculated and the damper adjusted until the excess air becomes 40 percent.

When the water flow calorimeter is operated with humidity and temperature control of the combustion air, accurate knowledge of amount of excess air is not needed.

Recording calorimeter (Fig. 7) uses a combustion air meter that in operation delivers the required combustion air; including sufficient excess air, saturated at the temperature of the tank water. Corrections for variations in atmospheric humidity, or use of special humidity and temperature control equipment are not required.

Insuring Complete Combustion

Test procedures required on the water flow calorimeter insure excess combustion air and complete combustion of the gas sample if they are followed in detail. In any calorimeter involving combustion of gas, failure to burn the sample completely, will result in a low indication of heating value.

In the recording calorimeter, no detailed test procedure is specified to check the combustion air supply. Design and maintenance procedure tend to insure complete combustion. Hence, some information on imperfect combustion is required.

Flow diagram (Fig. 7) shows combustion air is divided into two parts, primary air and secondary air, by corresponding orifices. Size of these orifices determines actual flow of primary and secondary air.

Detection of imperfect combustion is done by observation of the flame, or by odor of the products of

combustion. Fast burning gases, such as coke oven water gas or oil-gas, will show incomplete combustion by flame appearance. On slow burning gases, such as natural gas or those of the paraffin series, detection is much more difficult. One problem with a slow burning gas is that velocity of flame propagation is low, and incomplete combustion results when the flame tends to lift, or certain parts of the primary air gas mixture are stratified with respect to the primary air.

All paraffin series gases require a high value of primary air for maximum ignition velocity. On most gases, ignition velocity below 60 percent primary air is zero. This does not mean that natural gas with less than 60 percent primary air will not burn. Required air will come from the secondary air. Maximum ignition velocity occurs above 83 percent primary air. On such gases, increasing primary air from 60 to about 80 percent materially increases ignition velocity without appreciably increasing the port velocity. Thus, a smaller flame is produced.

On a recording calorimeter, a hard flame is desirable when operating on natural gas. This can be accomplished by increasing size of primary air orifice, or decreasing size of secondary air orifice.

It is important to keep burner tubes centered. Special attention should be given to position of the inlet tube. This precaution will prevent the flame from striking the surrounding tube and possibly reducing the flame temperature below the ignition point. Partial impingement may thus cause incomplete combustion.

Quantity of Gas Burned

The 0.1 cu ft wet test meter is used to measure volume of gas used during a test with the water flow calorimeter. To determine the corrected volume at standard conditions, the observed volume is corrected by the meter calibration factor, and the pressure, temperature, and saturation condition existing during the test.

The meter calibration factor is determined on a test with fractional cubic foot bottle. Detailed instructions are given in the ASTM publication D900-55. Before calibrating the meter, check pressure drop through it when passing about 5 cu ft per hour. Pressure drop should not exceed 0.1 in. of water and should be uniform throughout a drum revolution. A larger pressure drop will indicate excessive bearing friction or other defects. Occasional calibration at two rates of speed, one at the rate of usage, and the other at 10 percent of this speed, is useful to detect an indication of defect in the meter. Differences in capacity at two speeds will be an indication of some defect.

A large number of tests have demonstrated temperature of the meter water gives an accurate indication of the gas temperature. It is now conceded that gas is saturated at this temperature, independent of the saturation of the entering gas and the ambient temperature. The wet test meter thermometer should be graduated in intervals of 0.5 F from 54 to 101 F. It should be calibrated with a calorimeter thermometer and these corrections used in determining gas temperature.

Absolute gas pressure is the sum of meter pressure indicated by the manometer (graduated in 0.1 in.) and the corrected atmospheric pressure. This atmospheric pressure must be measured by a mercurial barometer that is corrected to eliminate errors from imperfect vacuum, capillarity, scale, impure mercury, gravity, and temperature. Calibration can be obtained by comparison with a correct barometer at a nearby Weather Bureau station. It is important to remember the barometer readings must be corrected to equivalent inches of mercury at 32 F.

On the basis of the corrected gas temperature and pressure, the gas volume factor F is determined from tables included in D900-55 or Bureau of Standards Circular C-464.

The preceding information has assumed the 0.1 cu ft meter is being operated at rates below 10 cu ft per hour. Most 0.1 cu ft meters, at rates of 10, 15, 20, 25, and 30 cu ft per hour, will deliver 0.05, 0.2, 0.4, 0.6, and 1 percent more gas respectively than the same meter will deliver at 5 cu ft per hour. It is also necessary to use complete meter drum revolutions in the volume measurements because meters frequently vary in their delivery for like angles of drum rotation.

In the recording calorimeter, gas is metered by a similar type of wet meter. The meter is driven through a suitable gear train by an electric motor which also drives the combustion air and the heat absorbing air meters. These meter volumes are determined by tank water level maintained by the overflow weir. (See Fig. 7.)

Conditions of gas measurement (pressure, temperature, and saturation) are established as atmospheric pressure, temperature of the tank water, and saturation at this temperature. **In calorimetry, the important ratio is that of volume of gas burned to weight of material heated.** In the recording calorimeter, this ratio of gas volume to heat absorbing air volume is established under identical conditions of pressure, temperature, and saturation. No barometer, line pressure, or temperature readings with their associated corrections are necessary.

Gas meter calibration is obtained on an air-gas ratio test in which the gas meter position is established. This sets the correct ratio of gas burned to air heated when the calorimeter is in operation.

Quantity and Temperature Rise of Heat Absorbing Material

A water flow calorimeter, as the name indicates, employs a weighed stream of water as the heat absorbing medium. Water is collected for a definite number of revolutions of the 0.1 cu ft wet meter and weighed on an equal arm balance with a capacity of 10 lb avoirdupois with a graduated beam reading to 0.001 lb and sensitive to this amount under full load.

Measurement of temperature rise of the water is obtained from the inlet and outlet water thermometers. In this connection, it should be remembered that an error of 0.15 deg in temperature rise measurement will cause an error of 1 percent in the observed heating value. Consequently, the following points are important:

1. Both thermometers of the mercurial type with graduations every 0.1 and of sufficient size to permit a reasonable estimate of the reading within 0.01 F.
2. They are to be of approved glass and constructed so bulb is actually in the stream of flowing water.
   a. The thermometers must be located so they measure true temperature of the flowing water entering and leaving calorimeter.
   b. Formation of "dead" space around bulbs must not be possible in order to prevent errors due to stagnant water or entrapped air.

c. Outlet water thermometer bulb must not touch baffle plates in outlet mixing chamber. In most calorimeters it should be within 1/32-in. of the top baffle plate.

3. Thermometers are to be calibrated by National Bureau of Standards and the certified calibration and the calculated stem corrections applied to the readings.

   a. Periodically, thermometers should be checked for a shift in calibration. Any difference correction observed should be applied to the temperature rise.

   b. The procedure to determine the correction is described in detail in ASTM Specification D900-55 on water flow calorimeter. This publication suggests the determination be made every month.

Description of the recording calorimeter shows the instrument uses a metered stream of saturated air as the heat absorbing medium. This is one of the most important differences between the recording calorimeter and the water flow type. The problem of maintaining a ratio of gas burned to material heated is thus simplified, as both follow the same physical laws.

In the recording calorimeter, a type of wet meter is used to measure and control the heat absorbing air. Meter inlet takes atmospheric air, which is delivered to the heat exchanger at the temperature of the tank water and saturated with water vapor at this temperature. Therefore, both gas and heat absorbing air are metered under the same conditions of pressure, temperature, and saturation. Both meters operate in a common water tank with level maintained by the overflow weir and pump, and are driven from the same electric motor so that the ratio of gas to heat absorbing air will be determined by the capacity of each meter per revolution and the speed of rotation.

In order to establish the desired gas-air ratio, a test (air-gas ratio test) is performed periodically. The two meters are operated in series at the required speed with a prover bell floating on the line between them. The gas meter is adjusted in the water to give a capacity indicated by the prover which is equal to the heat absorbing air meter capacity under the conditions of the test.

When actually making the heating value measurement, the heat absorbing air meter is operated at a higher speed and the gas meter is operated at a speed to give the theoretical full scale temperature rise. This is accomplished by a simple change in gearing. The recording calorimeter eliminates an individual determination of gas volume and weight of material heated with all of the associated corrections. Instead, a simple test involving determination of the difference in volume of two wet test meters is all that is required to establish the fundamental ratio of gas burned to material heated.

Temperature rise of the heat absorbing air is measured by a pair of accurately calibrated resistance thermometers. These thermometers are two of the legs of a *Wheatstone bridge circuit*. Fundamental measurement consists of determining resistance difference of the two thermometers.

Pairing of nickel wire thermometers involves selecting two thermometers that have almost identical temperature characteristics and essentially the same resistance at 60 F. They must be used as pairs. From calibration data on the exit thermometer (Fig. 7), the resistance difference corresponding to full scale temperature rise is calculated. This value is then used in the design of the slide wire. The slide wire is calibrated at a number of intermediate points to insure point to point as well as overall accuracy. A given slide wire is calibrated for a specific pair of thermometers and the three parts must be retained as a unit. Thus, a slide wire can be calibrated to match any given pair of thermometers, but thermometers cannot be calibrated and paired to match a given slide wire.

As previously outlined, the slide wire can be designed to give results in Btu per cubic foot at any desired basis of measurement without using any correction factors on the instrument reading and chart record. The full scale temperature rise for results at 30-in. Hg-60 F-Saturated is 42.652 F. For any other basis of measurement, this temperature rise is corrected by the factor as given in Fig. 1. For example, to give results at 30-in. Hg-60 F-Dry, the factor is 1.0177. The corrected temperature rise is then 42.652 divided by 1.0177. From this value, slide wire design resistance is determined.

Differential correction for the resistance thermometers on the recording calorimeter, is accomplished by a cold balance test. Calorimeter is operated with the bleeder burner lighted, but with the main burner extinguished. Heat absorbing air is then passing through the calorimeter without being heated. After about one hour, the two resistance thermometers will be at the same temperature and the balancing rheostat should be adjusted to produce a zero reading on the recorder scale.

The two thermometers being at the same temperature, the test is actually adjusting the recorder circuit to compensate for the small difference in resistance between the two thermometers, and any difference in resistance of the electrical connections involving the thermometers. Pairing of the two units results in selecting a pair with almost identical temperature characteristics. Thus, the cold balance test can be performed at any stable temperature within the operating range from 60 to 90 F, and a satisfactory adjustment will be secured.

Method of determining temperature rise in the recording calorimeter is another important difference between it and the water flow type. In the recording calorimeter, temperature rise of the heat absorbing air is determined by a measurement that is related to the difference in temperature of two thermometers. In the water flow type, temperature rise of the water is determined by two independent temperature measurements. Making two independent measurements of a change in a condition in order to determine that change introduces many more problems in securing desired accuracy than are involved in a single measurement of the change itself.

Heat Exchange

A uniform flow of water through the water flow calorimeter is the result of maintaining a fixed head of water, or pressure drop through the instrument, and introducing an adjustable restriction in the water path. The head is established by a difference in height of the inlet weir (Fig. 3) and the outlet weir. The adjustable restriction in the water path is the quadrant valve. However, a variable resistance to water flow can be introduced by deposits of dirt, or entrapment of air. The latter difficulty can cause an erratic temperature rise in the calorimeter.

Description of operation of the water flow calorimeter, given previously, pointed out the heat exchanger resulted in imparting to the flowing water practically all of the heat resulting from the combustion of the

test gas. Actually, these products leave the flow calorimeter at about 1 deg temperature above the inlet water temperature.

In the recording calorimeter, heat absorbing air is delivered by the heat absorbing air meter to the heat exchanger. The meter used is a type of wet meter designed to have a uniform delivery characteristic. Its capacity will be affected by bearing wear and any accumulation of deposits due to dust in the air. Periodic air-gas ratio test compensates for these gradual changes. Foreign restrictions in the path of the heat absorbing air can change the delivery characteristic. Periodic inspection and cleaning of thermometers, heat exchanger, and passages helps avoid difficulty.

In giving up heat to the heat absorbing air, flue products are cooled approximately to the temperature of the tank water. Excess temperature is somewhat higher than in a water flow calorimeter. This is desirable because the sensible heat of the products of combustion, plus the latent heat of vaporization of the water necessary to resaturate the flue gases at the excess temperature, tend to equal the latent heat of vaporization of the excess water. This would have been condensed if the flue products had been cooled to the tank water temperature.

Determination of Heat Losses

A detailed discussion of heat losses in a calorimeter is beyond the scope of this section, and since it has been very adequately covered in the literature, we will consider only the types of losses involved. In the manual water flow calorimeter the following summary can be made.

1. **Heat loss from the calorimeter to its surroundings** is a result of the fact that parts of the instrument are operating above room temperature when the inlet water temperature is at the combustion air temperature. This includes surface losses, sensible heat in the products of combustion resulting from excess temperature on discharge, and latent heat of vaporization of water saturating the products at this excess temperature.

2. **In actual operation, the calorimeter may be operated when temperatures of the inlet water and combustion air differ.** This represents a change in heat loss which must be considered in addition to point (1) above.

3. **Variation in surface loss when the combustion air and room temperature are not equal.** The assumption of equality was made in considering the losses in points (1) and (2) preceding.

4. **Heat losses and/or gains, which result from the fact that the amounts of water vapor entering and leaving a calorimeter are not equal,** are generally classed in the humidity correction. Usually, more water vapor leaves the calorimeter than enters it, and the heat of vaporization of the excess water vapor is not measured. Since this amount of heat is included in the definition of total heating value, the loss must be determined in order to correct the observed heating value. Since the correction is frequently of considerable magnitude, the loss must be evaluated accurately in order to make a precise determination of heat value. Use of humidity and temperature controller on the combustion air permits elimination of the humidity correction, or at least a very material reduction in its magnitude.

Heat losses in the recording calorimeter occur between the points of temperature measurement (entrance and exit thermometer, Fig. 7) of the heat absorbing air. They are reduced to zero by jacketing the burner structure with a return flow of the heated air. On each calorimeter, the required adjustment is made by setting the return flow baffle to give the required heated zone surrounding the burner.

Proper setting is determined by burning a gas of known heating value and known combustion characteristics, and then adjusting the baffle to a specified theoretical reading. Hydrogen has normally been used as this standardizing gas because its heating value was known with a greater degree of precision than was expected from the recording calorimeter. Because hydrogen is quite different in certain combustion characteristics from commercial gases, the theoretical reading required is not exactly the same as the total heating value of hydrogen.

Recently, certified tanks of methane have been made available through the American Gas Association. Certification of the heating value is done by the National Bureau of Standards. The certified gas represents another standard gas that can be used on recording calorimeters particularly of the 900 to 1200 Btu range.

It should also be remembered that, in the recording calorimeter, the combustion air is saturated, and because of the stabilizing effect of the tank water on the air surrounding the burner, the heat losses considered on the water flow calorimeter are eliminated or very materially reduced. Thus the calibration and standardization procedures on the recording calorimeter eliminate all correction factors, and results are given directly in total heating value.

Variation in Test Conditions from Definition

It is also necessary to take into account in the determination of total heating value by a calorimeter, the effect of variations in the test conditions from those specified in the definition. The definition includes two essential points.

1. Gas, air, and products of combustion are to be at 60 F. The water temperature involved is 59 F on the basis of the definition of the Btu.

2. Water formed by the combustion is condensed to liquid at 60 F.

We have already discussed the correction of the gas volume to standard conditions.

The previous section considered heat losses in the calorimeter. Corrections for these did not include the difference in heat capacity of the combustion products and the gas and air from values at 60 F. Thus, a minor correction is required when the calorimeter is operated at any temperature other than 60 F.

In addition, it is necessary to correct for the variation of the specific heat of pure water with temperature. Again a minor correction is required for operating temperatures other than 60 F.

These correction factors are not applied to the results of the recording calorimeter because they are either not involved, or have been included in the slide wire calibration or standardization of the instrument.

Calculation of Total Heating Value

Description of the manual water flow calorimeter and the analysis of the fundamentals of measurement involved, have disclosed a number of calculations required in order to convert the observations made during a test into total heating value in Btu per standard cubic foot. The procedure involves applying to the actual observations, corrections for calibration or other inherent errors of the measuring instruments and conversion of units observed to a standard base.

From this data, the so-called "Observed Heating Value" in Btu per standard cubic foot is calculated.

$$\text{Btu} = \frac{\text{Weight of Water (lb)} \times \text{Temp. Rise (F)}}{\text{Gas Vol. (cu ft)} \times \text{Vol. Factor (F)}} = \frac{WT}{VF}$$

To this result is added the combined humidity and minor corrections and the correction for water temperature all expressed in Btu per standard cubic foot. Final result is total heating value in Btu per standard cubic foot.

We also see from the recording calorimeter fundamentals that it gives an indication and record directly in total heating value without the necessity of calculations or corrections.

Conclusion

The product of the gas industry is energy, and because of the industry's "standards of gas service," it is always available, easily controlled, easily conveyed to a desired point, and there readily converted into heat. The industry must define the requirements involved in the correct measurement of the energy. Two measurements are essential in determining this energy. They are volume and heating value per unit of volume.

Total heating value of a gas involves an accepted definition of the term and definitions of associated facts. A review of the definition shows the basis of measurement of the cubic foot is involved. Apparently, in an effort to give results of the heating value determination on the basis of local conditions, a wide variety of specifications of the standard cubic foot has arisen. A number of advantages result from establishment of a uniform standard for the cubic foot. The *National Bureau of Standards Circular No. 405*, "Standards of Gas Service," 24 years ago, cautioned companies to avoid various billing practices because of the confusion that would result from local differences in practice.

In the same publication, the foreword, reviewing the changes that had taken place from 1922 to 1934, says, "Probably the most fundamental change of all has been a psychological rather than a physical or economic one and may be stated as the recognition that the Fuel-Gas Industry must be guided by facts rather than tradition." Certainly, the important changes made since 1934 further emphasize the necessity of putting facts into practical use. Today we continue to seek facts and to be guided by rules.

Acknowledgment

This chapter on *Gas Calorimetry*, concluded in this issue, has been prepared by C. W. Warner, Cutler-Hammer, Inc., Milwaukee, Wisconsin, adapted from a presentation made at the 1957 AGA Chemical, Engineering, and Production Conference.

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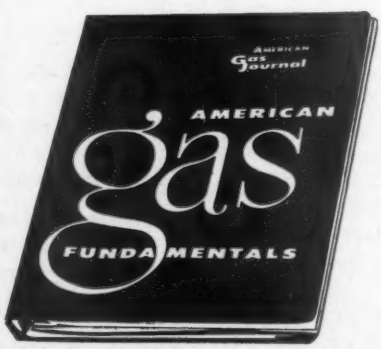

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A Practical Approach to Field Testing and Maintaining Orifice Meters

Howard H. Holmes
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MUCH HAS BEEN WRITTEN during the past 50 years detailing the various mathematical and theoretical concepts that must be applied to orifice meters. An astute meter man can greatly increase his stature by reading these highly informative articles in the comfortably air conditioned confines of his office. Unfortunately, when a meter man is making his rounds, the wind often is blowing hard from the Northwest and the air temperature near 5 F, these theoretical niceties seem like faint echoes from outer space.

Under such conditions, a meter man is still expected to keep as many meters operating as accurately as possible. Human nature being what it is, he will not be consulting tables of cubical expansion of mercury, or interpolating manometer factors between 0.9990 and 0.9991.

Actually, when a meter man approaches a meter setting, he is a lucky man for he only has three basic worries:

1. The meter tube and orifice plate,
2. The manifold or gage line pipe,
3. The flow, pressure, recorder.

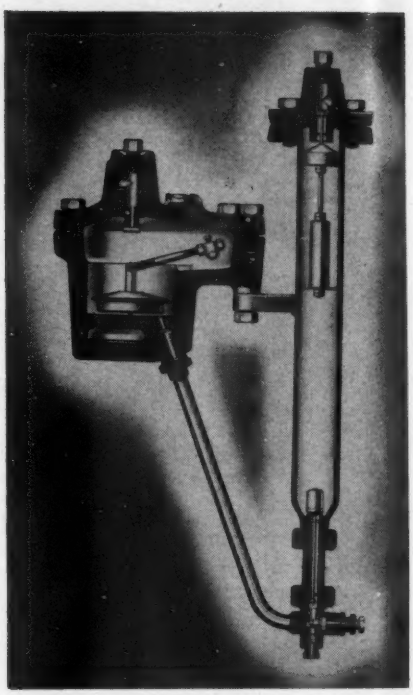
To do the job that is expected of him he must be sure that each of these elements is working properly:

Meter tube. Condition of this unit is usually dependent upon two factors — the original design, (does it meet AGA or contract specifications?) and the type of gas being measured (is it sweet, sour, full of water, dirt, condensate, etc?).

The first factor is not usually the concern of the meter man. If the design is faulty, then obviously a new meter tube must be installed.

The second factor does concern the meter man because condition of the meter tube is directly dependent upon condition of the fluid being measured. Sour gas can cause internal corrosion and pitting which will alter the flow pattern. Extremely dirty gas can erode the meter tube and increase the effective internal diameter. Scale and dirt under extreme conditions can stop flow through the meter tube at restricted portions such as straightening vanes, and orifice plates.

A proper meter tube should be flanged so that the upstream section can be removed periodically for visual inspections. Frequency of such inspections is usually governed by past experience or company policy.



Cutaway of 100-in. orifice meter showing differential manometer.

Orifice plate. This is the heart of orifice meter measurement, and *any* deviation of its condition from specification can cause errors in measurement. The plate, as installed, must meet specifications or it will be impossible to obtain correct measurement. The meter man's job is to see that the plate continues to meet contract specifications, and replace it when it fails in this respect.

Practically speaking, only three things are needed to check a plate, a clean rag, micrometer calipers, and horse sense.

The first check on proper plate condition is the upstream edge of the orifice itself. The upstream edge condition is probably the greatest one source of orifice meter trouble. These conditions should be watched for:

1. Nicks or scratches on the upstream orifice edge. If these conditions are present plate must be replaced or rebored. A good test of plate edge sharpness is the ability of the upstream edge to cut and flake the fingernail by scraping the edge over a fingernail.

2. Rounding of the upstream edge cannot be tolerated. This edge should be sharp and square on all 360 degrees of radius. A rounding of the upstream edge will result in low measurement.

3. An accumulation of dirt or ice on upstream edge is sometimes encountered. This condition will give results that are low.

4. Damming of dirt or liquid behind plate. Measurement will be high or indefinite, depending on the degree of damming.

5. Plate should be flat. Specifications say "any plate which does not depart from flatness along any diameter

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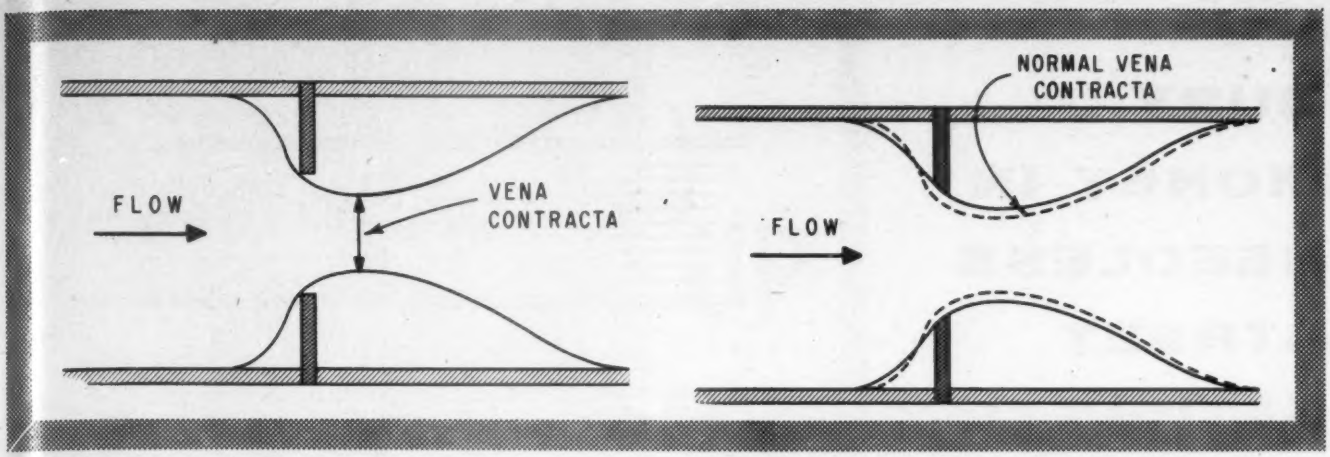


Normal flow with sharp square edge orifice plate.

Condition of flow with orifice having rounded upstream edge.

by more than 0.10-in. per inch of the dam height." For practical purposes the plate should be flat — no exceptions.

6. **Size of the orifice should be checked** with good calipers to verify the tagged dimensions.

In addition to these edge and bore conditions several other variables should be checked, although these factors are not as critical or prevalent as edge conditions. Be sure the orifice bore is concentric with the meter tube. Using standard plates in regular orifice flanges or fittings will generally rule out this possibility. Flange gaskets should be checked to make sure they do not project inside the meter tube.

Meter gage lines and manifold. Leaks or condensate traps in gage lines can give false differentials and on low-pressure measurement, a very small piping leak can cause extreme errors in measurement. Any condensate trapped in gage lines will give erratic differentials due to false heads and "percolator effect."

Troubles are sometimes encountered with freezing in gage lines. These can generally be eliminated by increasing the gage line size to ½-in. complete with ½-in. valves. Tools needed for checking piping leaks are simple. *A small brush and soap suds.*

Another practical leak test can be made by closing the high and low side needle valves. When the meter is in service any leak in the high side of the meter or manifold lines will cause a drop of the differential pen, and any leak on the low side will cause a raising of the differential pen. The valves should, of course, be in good condition to obtain correct results.

Flow, pressure recorder. Here is the "glamour girl" portion of the orifice meter — the differential pressure-static pressure recorder. With any mechanical device such as this, there are literally hundreds of troubles that can appear. By and large, they are all confined to either mercury, stuffing box, check valves or clock. A good routine to follow when checking a recording gage is to prepare a check list and commit it to memory. Here is a typical check list and some of the pitfalls to look for when completing this list.

I. Manometer Check.

A. Zero meter under pressure.

B. Take out of service and bleed pressure to zero.

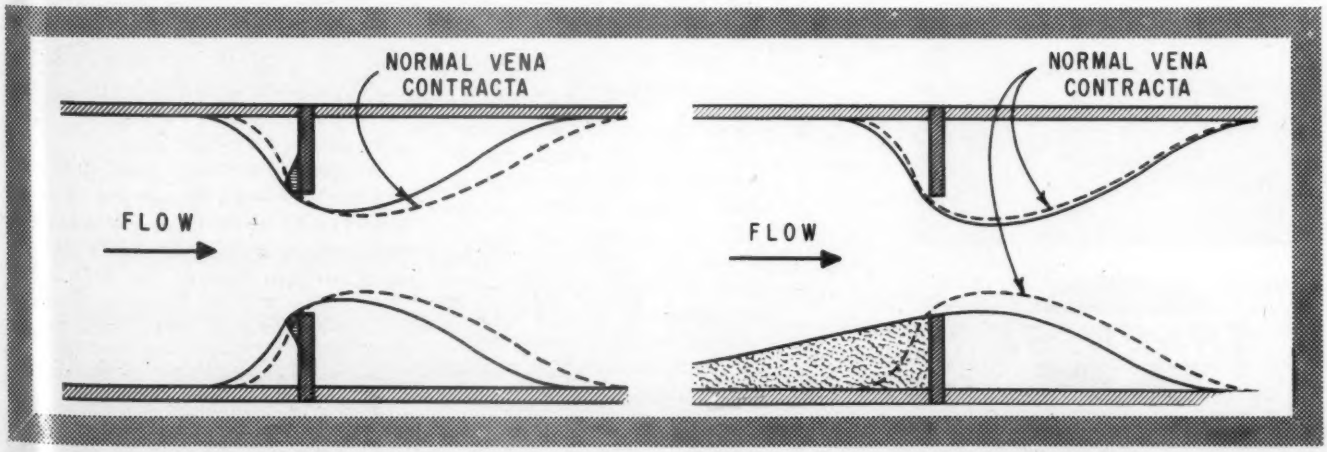
C. Attach suitable range glass "U" tube water column manometer and standardize with differential pressure manometer. If 100-in. recording gages are used, a high quality mercury type manometer can be used with some sacrifice in accuracy. If the differential pressure manometer is not standardized throughout its entire range, then a complete cleanup and recalibration is indicated.

D. Drain the mercury and remove the low and high side covers.

E. Check level of manometer.

F. Remove the differential shaft and stuffing box. Check shaft for binds by rotating slowly, clean thoroughly (assuming a Teflon packed stuffing box).

G. With a clean rag and suitable inert cleaning fluid (not carbon tetrachloride—use *Stoddard's* solvent) clean the high and low side chambers and



Condition of flow with accumulation of dirt on upstream face.

Condition of flow resulting from dirt, liquid, or foreign material accumulating ahead of orifice.

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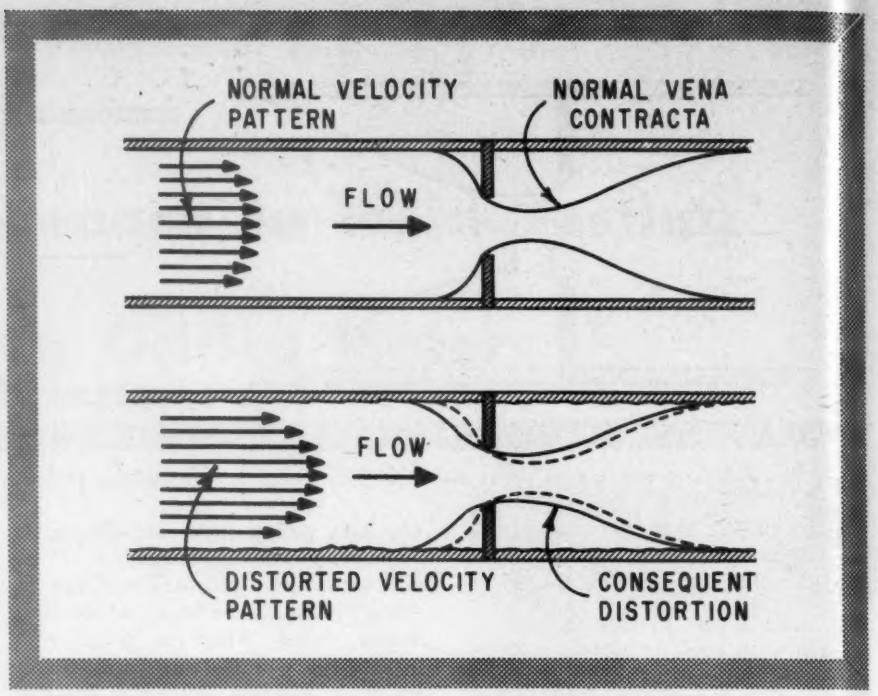

Effect of pipe inside roughness on flow through an orifice.

the float. If the gage is extremely dirty, remove the range tube and clean. Normally, this is not necessary.

H. When the interiors of the high and low side chambers are completely dry reassemble high side cover and fill manometer with clean mercury.

II. Case Work.

A. Arc the differential pen and set pressure pen 15 minutes ahead of differential. When arcing a pen remember: *If it seems too short, shorten it; if it's too long, lengthen it.*

B. Zero both pens.

C. Check pens for chart contact. For proper operation, a pen should touch the chart as lightly as possible and still ink properly.

D. Check interior of the case and wipe out with clean rag if needed. If the case door is loose fitting readjust door latch for proper seal. Case should be checked for tightness to manometer body. If mounting screws and brace bracket become loosened due to "back scratching" cattle, errors in recording will result.

E. Wind clock and check to see if clock hub and chart plate are in exactly the same plane.

III. Final Calibration.

A. Standardize against a suitable "U" tube water column manometer as in I-C. If the meter is slow, shorten the float lever arm, and if it is fast, lengthen the float lever arm.

B. Standardize the static pressure element with a suitable range dead weight gage and change calibration if necessary.

C. Install proper chart, ink pens and check zero.

D. Return meter to service.

This check list as shown is not complete to the last detail but is presented here as a guide and maybe an "idea provoker." This check list may seem long and time consuming on the printed page, but many of the operations are mere visual observations and some can be omitted. Speed of completing such a list comes with experience.

As stated previously, many hundreds of variations and additions can be made to any or all of the ideas related in this article; but, as our title indicates, this is an attempt to give the field meter man a practical set of guide posts to govern his actions.

Acknowledgment

This article prepared from a presentation made at the Fifth Annual Gas Measurement Institute, Liberal, Kansas, October 1957. * * *

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Gas grid installation at Grassy Point, New York, was completed in brief span of one month by Rockland Light and Power Company, Nyack, New York. The new line, 5200 ft of 6-in. and 1500 ft of 2-in., serving residents of Grassy Point and a new gypsum board plant on the Hudson River, consisted entirely of wrapped pipe. Most of excavation dirt was removed because of its claylike character and replaced with run-of-bank gravel. In photo above, left, contractor's crew is shown lowering in a section of 6-in. main in River Road at Grassy Point. Lower right, workmen weld the 6-in. pipe. Upper right, company inspector Hugo Robus checks coating with holiday detector prior to lowering-in. Contractor was Underground Construction Company, Inc.

"WHERE GAS IS GROWING"...

Distribution Developments

... news about current and planned construction

Southern California Gas Company, Los Angeles, for the third straight year has a capital budget in excess of $40,000,000. The 1958 figure, third highest in the utility's 90-year history, totals $40,263,000. Largest single item in the 1958 budget is a projected $12,869,000 for additional mains, meters, and services to supply new customers expected to be connected in 1958. Three new buildings will be completed at an estimated cost of $1,175,000 — including a material depot and meter shop at Riviera, a new division headquarters building in Downey, and an additional operating base in Canoga Park. Among projects scheduled for 1958 is construction of distribution system in the company's Cherry Valley district that will include 40,000 ft of 2, 3, and 4-in. pipe, to cost an estimated $80,000.

North Shore Gas Company, Waukegan, Illinois, has a number of projects underway or scheduled to begin shortly in its service areas. Included are 3520 ft of 6-in. intermediate pressure feeder main underway in Winnetka, being constructed by W. H. Lyman Construction Company; 3000 ft of 4-in. intermediate pressure feeder in Zion, by company forces; 9000 ft of 8-in. high pressure feeder main underway in Lake County; 600 ft of 6-in. low pressure distribution main replacement completed and 1600 ft of 4-in. intermediate pressure distribution main underway in Waukegan, by company forces; 2100 ft of 4-in. intermediate pressure distribution main completed in Libertyville, by W. H. Lyman Construction Company; 1000 ft of 4-in. intermediate pressure main scheduled to begin May 1 by company forces; 1700 ft of 8-in. intermediate pressure main underway in Lake Forest; 2800 ft of 6-in. low pressure distribution main scheduled for construction in mid-May in Lake Bluff; and 1200 ft of 8-in. intermediate pressure main replacement in downtown Glencoe, completed by W. H. Lyman Construction Company.

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Equitable Gas Company, Pittsburgh, Pennsylvania, makes quick work of its construction jobs in order to minimize the strain put on normal suburban living in neighborhoods where new mains are being constructed. Case in point here is installation of 2000 ft of 20-in. high pressure supply line, made recently for the company by contractor A. J. Cindrich, Inc. Upper left, pipe is being lowered into a just-opened trench. Gas and water service lines are quickly reconnected (upper right) and as soon as backfilling is completed, paving and landscaping are begun. In this case (lower right) along Zephyr Street, worn flagstone walks were replaced with a smooth ribbon of concrete sidewalk.

Peoples Gas Light and Coke Company, Chicago, Illinois, has underway for 1958 a general construction program on its low and medium pressure distribution system throughout the Chicago area at an estimated cost of $3,350,000. Included in this construction are 162,000 ft of 6-in., 12,000 ft of 8-in., 34,000 ft of 12-in., 32,000 ft of 16-in., 2200 ft of 20-in., 2600 ft of 24-in., and 700 ft of 36-in.

The Tampa Gas Company, Tampa, Florida, has completed work on 3000 ft of 4-in. low pressure distribution main in Tampa, work done by Stanfield Construction Company. Proposed construction includes 25,000 ft of 8-in. high pressure main to serve a large industrial district.

Bridgeport Gas Company, Bridgeport, Connecticut, plans construction in 1958 of over 85,000 ft of new mains and extensions in its service area of Bridgeport, Fairfield, Stratford, and Trumbull. Included in the plans are 50,000 ft of pipe up to 4-in. diameter; 16,000 ft of 4-in.; 20,000 ft of 6-in., and 1500 ft of 8-in. Most of the work will be done by company crews. At Trumbull, construction will begin in June on buildings and facilities for a second city gate station, with completion scheduled for 1959.

Southern Union Gas Company, Dallas, Texas, spent approximately $11,000,000 in 1957 on additions and improvements of service facilities throughout its properties in New Mexico, Texas, Arizona, and Colorado. Over 14,000 meters were added to the system, bringing the total of residential, commercial, and industrial customers served to 310,000 in the 65-city area.

Ohio Fuel Gas Company, Columbus, Ohio, has begun work on approximately 7500 ft of 2, 3, and 6-in. gas main in northeast Columbus to provide gas service to the new Baby Farms addition of that city. Contractor for the job is Don Miller, Inc.

Peoples Gas System, North Miami, Florida, plans construction by company crews and contractors during 1958 of approximately 100,000 ft of 2, 4, and 6-in. high pressure mains and service extensions on its system — including Miami Beach, North Miami, Hallandale, Hollywood, Dania, and Fort Lauderdale. Cost is estimated at $200,000. Plans also include 5600 ft of 6-in. high pressure reinforcement main including a submarine crossing, at a cost of $28,000. At Miami Beach,

Roadability and dig-ability are combined in this truck-mounted backhoe with a quick on-and-off feature. Backhoe can be easily removed, leaving truck free for other work when not needed for digging. For transporting on the truck, the backhoe is hydraulically shifted up and over the rear axle, and can be driven at regular road speeds to the next job site.

Trench digging with Cleveland cuts repaving costs 25%

ERN CONSTRUCTION CO's new Cleveland 110 Trencher cut repaving costs 25% on the installation of 11,000 feet of 12 and 8 inch pipe throughout East Brunswick Township near Springfield, New Jersey. Trench was 5½ feet deep and 24 inches wide. Foreman Henry Appleby says:

> **"We're able to reduce repaving costs 25% with the Cleveland because it cuts cleaner, narrower trench than the backhoe method we used previously."**

"We get better production, too," says Appleby. "The Cleveland digs about 780 feet of trench per hour compared to about 100 to 150 feet with the backhoe."

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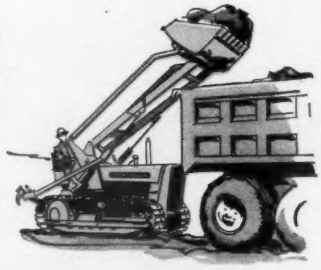


Heavy-duty front-end loaders with rear-end scarifiers make fast work of earth moving. Exclusive clutch-type direction reverser saves time, effort on many jobs.

Your John Deere industrial dealer can tell you of the many other types of equipment available for use with John Deere Industrial Tractors.

JOHN DEERE Industrial Tractors and Equipment

Completely Engineered for Industry

For Further Information Write: **JOHN DEERE INDUSTRIAL DIVISION • MOLINE, ILLINOIS**

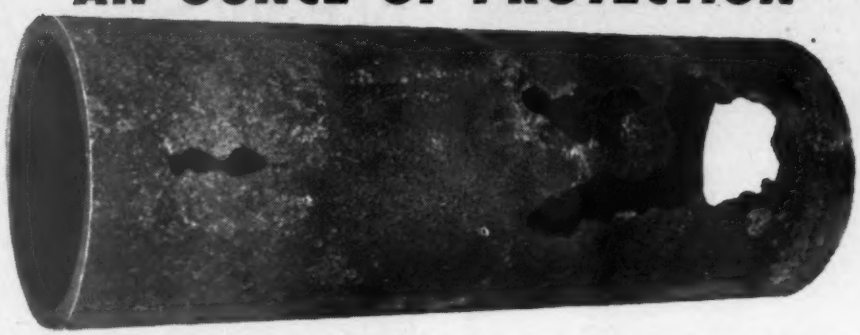
Major step in mobilization of private resources for Civil Defense emergencies has been made in Connecticut with a "Sealed Pledge of Readiness" made to the state CD by some 500 officials and employees of C. N. Flagg Company, Inc., of Meriden, Connecticut. The pledge covers 286 pieces of moving equipment worth $1,000,000, all of which would become available to state CD authorities whenever an emergency is declared. Peter Flagg, president of C. N. Flagg Company, left, and Captain Leo J. Mulcahy, state Civil Defense director for Connecticut, are shown above attaching a CD emblem to one of the company's pieces of heavy equipment.

a 3100 ft, 2-in. high pressure submarine reinforcement main to the island area has been laid by M. B. Construction Company at a cost of $7000. An undetermined amount of 2, 4, 6, and 8-in. main extensions and replacements will also be made during the year on the system as required by relocation of municipal and state highway and bridge improvements.

Lone Star Gas Company, Dallas, Texas, has budgeted $9,754,000 for construction by its three distribution divisions in 1958. The company added 26,000 new customers in 1957 and expects to add an equal amount in 1958, giving the company 830,000 customers at the year's end in the 455 communities it serves. Distribution construction expenditures planned by divisions include $5,203,200 by the General division; $2,150,000 by the Dallas division, and $2,400,800 by the Fort Worth division.

Iowa Southern Utilities Company, Centerville, Iowa, plans construction during 1958 of 5500 ft of 2, 3, and 8-in. low pressure main extensions in Burlington; 3800 ft of 3 and 4-in. low pressure main extension and 1900 ft of high pressure main in Centerville, and 6900 ft of 2, 3, and 4-in. low pressure main extensions in Mt. Pleasant. Other plans include 90,000 ft of 2 through 8-in. intermediate pressure distribution system in Osceola; 31,000 ft of 2 through 6-in. intermediate pressure distribution system in Keota, and 35,000 ft of 2 through 4-in. intermediate pressure distribution system in What Cheer.

AN OUNCE OF PROTECTION



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TYPE 3 ENAMELS

SPECIFICATIONS

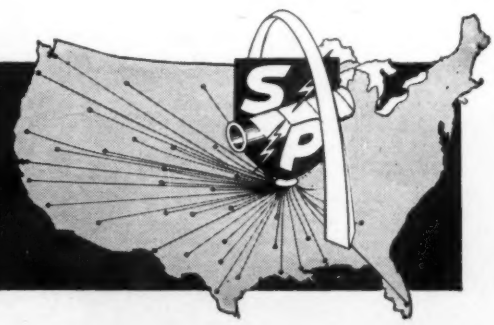
	IF-3	IG-3	IGF-3	IXF-3	IXG-3	2F-3	2GF-3
Steel Grit Cleaned	Yes	Yes	Yes	Yes	Yes	Yes	Yes
1	Primer	Primer	Primer	Primer	Primer	Primer	Primer
2	2/32" Enamel	2/32" Enamel	2/32" Enamel	2/32" Enamel	2/32" Enamel	2/32" Enamel	2/32" Enamel
3	1/32" Enamel	Glass	Glass	1/32" Enamel	1/32" Enamel	1/32" Enamel	1/32" Enamel
4	Asbestos Felt	1/32" Enamel	1/32" Enamel	Asbestos Felt	Glass	Asbestos Felt	Glass
5	Kraft	Kraft	Asbestos Felt	X or Seal Coat Enamel	X or Seal Coat Enamel	X or Seal Coat Enamel	X or Seal Coat Enamel
6	.....	.....	Kraft	Kraft	Kraft	Asbestos Felt	Asbestos Felt
7	.....	.....	.....	.....	.....	Kraft	Kraft

These specifications available in any type of enamel or asphalt

Yes, sir, and an ounce of Standard Pipeprotection is worth more than a pound of repair, for Standard Pipeprotection is the finest coating and wrapping you can buy.

Pipe once underground, becomes most expensive to dig up and repair or replace. Make sure your pipe stays down by specifying SPI coating and wrapping. Choose any of many specifications.

THROUGH FREIGHT RATES AT THE ST. LOUIS GATEWAY



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FOR GAS MAINS
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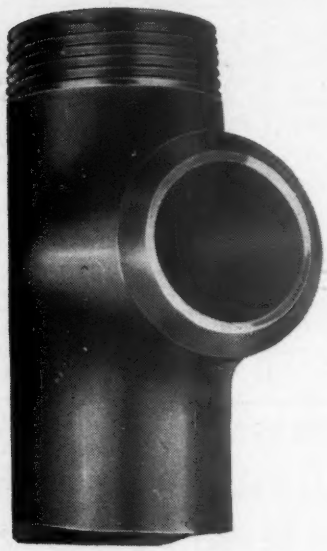

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NEWS

ABOUT THE GAS DISTRIBUTION INDUSTRY

Five Score and Ten Years. The Advertising Club of Washington recently presented the Washington Gas Light Company its "Achievement Award" in recognition of the gas company's 110 years of service to the community. Left to right: Everett J. Boothby, gas company president; C. S. Stackpole, managing director of American Gas Association; Arnold Fine, president, Washington Advertising Club, and John Hoy Kauffmann, business manager, Washington Star.

New Gas-Electric Combination

Following regulatory approval, Rockland Light and Power Company of Nyack, New York, and The Orange and Rockland Electric Company have formally merged into Orange and Rockland Utilities, Inc. Rockwell C. Tenney, former chairman of Rockland Light serves as chairman and a director, and Charles L. Hulswit as president and a director of the new company. Others named to management posts are: Richard L. Brickley, director; Herbert A. Burns, director; Samuel M. Cuddeback, Jr., director; Maurice W. Dennison, director; Isaac S. Hall, director; Charles W. Hawkins, director; Cameron F. MacRae, director; Edward A. Merkle, director; Roscoe W. Smith, director, chairman of the finance committee and vice president; Leland A. Smith, director and vice president; Charles H. Tenney II, director and vice chairman; Ralph E. Trower, director, treasurer, and assistant secretary; Charles W. Caldwell, vice president; Francis E. Manley, vice president; L. Earle Merrow, vice president; Arlyn H. Palmatier, vice president; Vernon M. F. Tallman, vice president; Richard F. Alexander, assistant treasurer; George A. Carlson, assistant treasurer; Palmer Y. Epler, assistant treasurer and assistant secretary; Frank C. Helme, assistant treasurer; Herbert P. Faber, secretary; Ford S. Relyea, assistant secretary, and Kenneth W. Ford, auditor.

IGT Summer Session Enlarged

Institute of Gas Technology of Illinois Institute of Technology has enlarged its summer session to offer five courses in natural gas technology, from June 7 through August 15. Two classes in "Natural Gas Distribution" will be offered in 1958. "Natural Gas Distribution — Fundamentals" will be presented June 9-27, and "Natural Gas Distribution — Selected Topics" will be offered July 28-August 15. First course will be a basic one and the second a modified course slated to meet specialized needs of more experienced men in the gas industry. Other courses include: "Natural Gas Production and Processing," July 7-25; "Natural Gas Transmission," June 9-27; and "Natural Gas Fuel Utilization," July 7-25.

Smith-Blair Goes Southwest

Smith-Blair Inc., South San Francisco, California, has opened a new 6000 sq ft assembly plant, a warehouse, and regional sales office in Henderson, Texas. In addition to providing better service to users of Smith-Blair pipeline couplings, connections, and clamps in the Midwest, Southern, and Southwest areas, the Henderson branch will also utilize several Texas industries as sources of supply in its manufacturing operations. The new branch is the third major expansion of the Smith-Blair organization.

Rockwell Plant In Production

Rockwell Manufacturing Company's new 106,000 sq ft manufacturing plant and West Coast repair center at Porterville, California, is now in limited production. The new plant — first major industrial facility in the predominantly agricultural San Joaquin Valley community of 7500 — produces and repairs gas meters and other Rockwell products for the West Coast market. Modern, one-story plant is completely air conditioned and uses a gas-absorption system.

Exports Expand, So Does Oronite

New company, California Chemical International, Inc., has been formed to take over the expanding export market of Oronite Chemical Company. Like its sister company, Oronite, the new firm will be a subsidiary of the Standard Oil Company of California. T. G. Hughes, president of the new company and also president of Oronite Chemical said the company's export business has "more than doubled in the past five years . . . and now accounts for over 20 percent of our total volume."

Heat Exchanger Patent Granted

A U. S. patent has been granted Utility Appliance Corporation for a gas furnace heat exchanger with an expansion section that dissipates stresses due to heat expansion and insures silent operation. Special U-type joint in the heater flue allows for expansion without restraint and eliminates noises incident to restrained metal expansion. Utility manufactures Gaffers & Sattler products.

Gas Tags Tag Gas Trucks. When the state of Washington switched to new license plate numbering system, Washington Natural Gas Company, through special permission, obtained the prefix GAS for all its service automobiles. Charles M. Sturkey, president, admires one of the plates.

Giant Clamp. Largest internal hydraulic line-up clamp built to date has been manufactured by M. J. Crose to handle 55-in. pipe in a special pipeline project. Company also makes smaller hydraulic type clamps for more conventional sizes of pipe. Giant-size dimensions of the clamp and its heavy construction are apparent in the photo.

Measurement Meet Set

More than 1000 persons engaged in the business of using, selling, or manufacturing equipment for gas measurement and regulation will gather on the University of Oklahoma campus, Norman, Oklahoma, on April 15-17 for the 32nd annual Southwestern Gas Measurement short course.

An outstanding group of speakers and instructors from the gas industry and the OU engineering faculty will staff the conference. They will discuss problems encountered in all types of gas measurement and regulation equipment and operations.

Canadian Merger

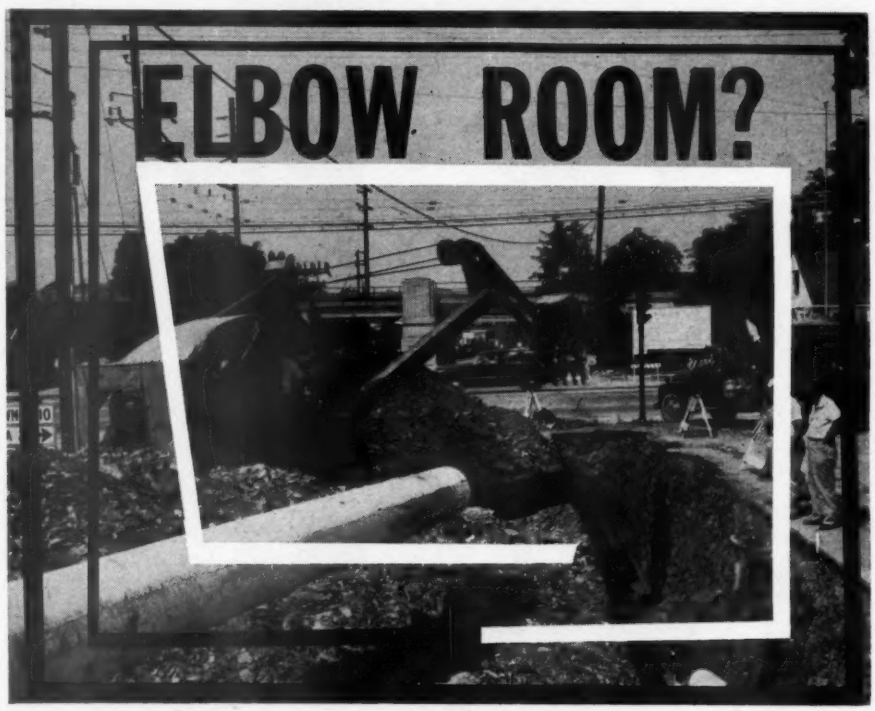
Two firms active in the LP-Gas industry, Draketown (Canada) Ltd., and James Petroleum Equipment, Ltd., have joined to become Draketown-James Ltd. Harry W. Townsend has been elected president and James MacArthur, vice president and general manager. New company combines experience and skills of former companies in the design, engineering and construction of propane plants throughout Canada for gas utilities, industrial gas users, and LP Gas distributors.

By proving that the "Thermal Eye" won't scorch even a facial tissue, Miss Helen Yalch, home service director for Oklahoma Natural Gas Company, rode away with a new Chevrolet Impala sports hardtop as top winner in the Automatic Range Top Demonstration contest sponsored by Robertshaw-Fulton Controls Company. Left to right shown presenting the keys to Miss Yalch is Tom Bacon, Chevrolet representative in Tulsa, Shirley Pemberton, home economist for the Thermostat Division of Robertshaw Fulton. Winning demonstration proved that when a facial tissue was placed in a dry sauce pan over 200 deg of heat, the "Thermal Eye" controlled the heat so well that the tissue was not even scorched. The same experiment over ordinary controls caused the tissue to burst into flames.

Sturkey Heads Washington Utilities

Charles M. Sturkey, president of Washington Natural Gas Company, Seattle, has been elected president of the Association of Washington Gas Utilities for the third time. The organization headquartered in Seattle is composed of eight gas distribution companies operating in the state of Washington. Elected vice presidents were: Nathan H. Gellert, Jr., president of Spokane Natural Gas Company, Spokane, and Edward Niederer Jr., executive vice president and general manager of Pacific Natural Gas Company, Longview. Robert C. Hayes continues as vice president and executive director.

Richmond's Department of Public Utilities and Commonwealth Natural Gas Corporation's poster campaign promoting gas heat cooked up a first award for poster design in markets of 100,000 to 500,000 population in October Advertising Association of America's sixth annual local outdoor advertising contest. More than 300 entries representing the best local outdoor advertising campaigns and designs of 1957 from outdoor advertising companies in all parts of the U. S., were entered in the contest.



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. . . like a chameleon, SHEEHAN adapts to the environment.

Whether a spread is strung over flat farm lands or crowded into a congested city has little effect on SHEEHAN'S efficiency and speed of operation. With a versatile staff of qualified personnel and a wide selection of modern equipment, SHEEHAN can easily adjust to existing right-of-way conditions.

Whether your next line is laid *mile by mile* or *block by block*, it will be successful if it's built by SHEEHAN.

Let Sheehan's experience work for you on your next pipe line project.

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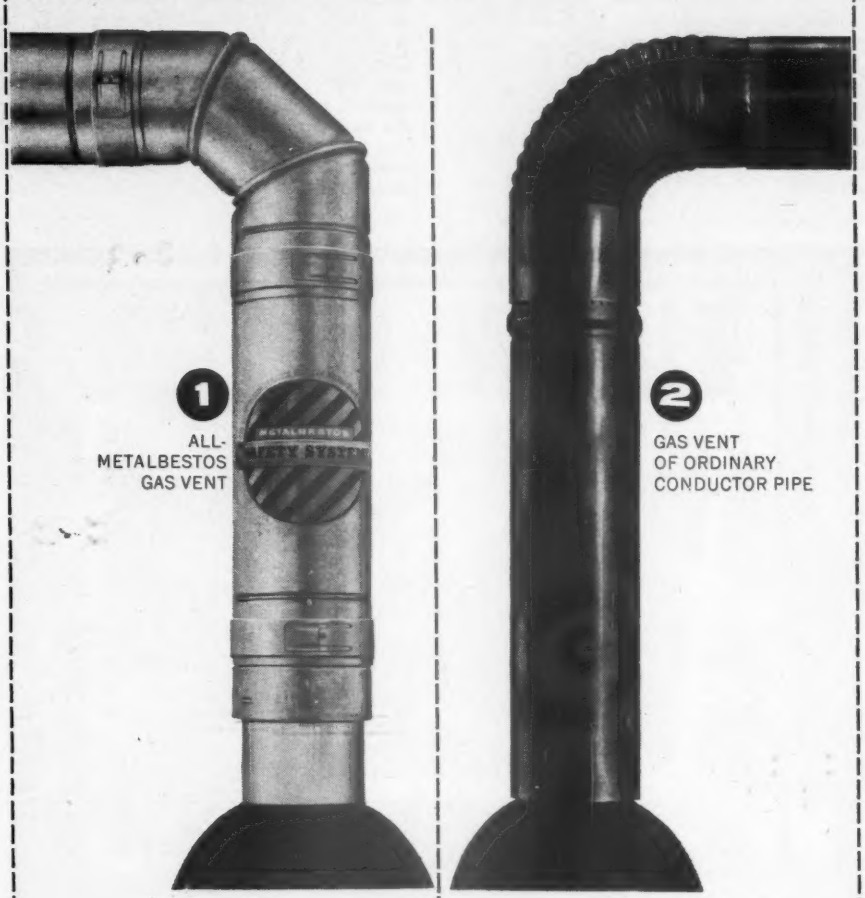
No Service Calls for One of These Vents!



Only when a utility service-man sees the red-and-black Metalbestos "Safety System" Seal can he be sure that vent failure isn't responsible for the consumer's service call. Then he knows that trouble lies below the draft hood . . . because the Safety Seal tells him an all-Metalbestos vent has been designed and installed according to the Metalbestos "Safety System" Gas Vent Tables.

The vent system behind the Metalbestos "Safety Seal" eliminates venting service calls . . . promotes the consumer's total enjoyment of gas heat.

Look for the Metalbestos "Safety Seal" and encourage its use. It's good for your business . . . good for gas.

For complete information on the new Metalbestos "Safety System" write Dept. AA-4.

Stocked by principal distributors in major cities. Factory warehouses in Akron, Atlanta, Dallas, Des Moines, Chicago, New Orleans, Los Angeles, Woodbridge, N.J.

METALBESTOS DIVISION
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News Notes

New company, Corrosion Control Products, recently formed by W. F. McNaughton, former vice president and sales manager of Plicoflex Inc., will be exclusive factory distributors for Plicoflex laminated tapes and asphalt coatings and Pipeline Coating and Engineering insulating spacers and Plico asphalt coatings for the Southwest. Company headquarters are located in Long Beach, California.

Rockwell Manufacturing Company of Canada, Ltd., has purchased the new 50,000 sq ft plant at Guelph, Ontario, recently occupied by Hammond Manufacturing Company. Acquisition of the modern brick and tile factory will enable Rockwell of Canada to meet increasing demand throughout the Dominion for the wide variety of products presently manufactured in its 92,000 sq ft plant at Guelph.

Industrial Combustion Inc., Milwaukee, newly formed manufacturers of commercial-industrial gas burners, has acquired the facilities of the former burner division of Cleaver-Brooks Company, including all patents, machinery, tools, jigs, patterns and inventory. The new company will supply all replacement parts for existing burner equipment. J. Verne Resek, former manager of the Cleaver-Brooks division, has majority stock in the new company and is president. Howard McCoy will be vice president in charge of engineering.

Gas Builds a Greater America has been chosen as the theme of the 1958 AGA convention to be held October 13-15 in Atlantic City, New Jersey. Alexander M. Bebee, chairman of the general 40th annual convention committee, said speakers will concentrate on four major subthemes namely: "What's Ahead," "Some Problems to Consider," "Meeting Our Opportunities," and "A Time for Greatness—Making the Most of our Opportunities."

Aluminum Tubing Company of Jacksonville, Florida, has recently changed its firm name to Roll-Weld Pipe and Tube, Inc. The company which recently expanded its operations with the addition of two new pipe mills, manufactures steel and stainless steel as well as aluminum pipe and tubing in outside diameters ranging from ½ through 14-in. and wall thicknesses from .028 through .250-in.

Lancaster Enlarges Parts Plant. Lancaster Meter Parts Company's plant at Lancaster, Ohio, has been enlarged and rearranged to increase production capacity and efficiency. The new addition houses larger stocks of materials and finished products resulting from the increased production. New stock and shipping room provides improved shipping facilities. Plant space formerly used for storage purposes has been incorporated into the main production room.

Gas Sales Rise in December. Total sales for gas utility and pipeline industries peaked at more than eight billion therms during December to reach an 8.8 percent increase over last December, the American Gas Association reports. Last years' comparative gain was only 4.4 percent. Rise was attributed to a greater number of customers, colder weather this year, and a greater use of gas by industrial customers. Industrial sales showed a year-to-year gain of 8.5 percent to a total of 3.37 billion therms despite the fact that industry production, as measured by the Federal Reserve Board index, was declining 7.5 percent. Of total sales during December, natural gas accounted for 7.756 billion therms — a rise of 8.9 percent over December 1956. Mixed gas sales advanced 7.4 percent to 240 million therms while manufactured gas sales slipped 12 percent to 21 million therms.

Range Shipments Decline. For the first month of 1958, gas range shipments rang up a skinny total of 129,900 units, 13.2 percent under the 149,600 units registered in January 1957. Other industry statistics announced by the Gas Appliance Manufacturers Association show 117,000 freestanding ranges and 12,900 built-ins were shipped during January representing decreases of 14.1 percent and 3.7 respectively over 1957 figures of 136,200 and 13,400.

Gas Furnaces Gain. Shipments of gas-fired central heating equipment in January skipped a pace ahead of last year, according to figures compiled by Gas Appliance Manufacturers Association. Total of 48,800 gas furnaces of the forced warm air and gravity types — a 2.3 percent increase — were shipped during the month compared to the 47,700 shipped in January a year ago. However, gas boilers used in residential heating dipped 1.9 percent below the 5200 shipped a year ago. Steady on par with last year were the 7300 units of conversion burners, used in changing heating systems from other fuels to gas, that were shipped this January.

"I understand natural gas sales are higher than ever."

Industrial furnace figures released from the Industrial Heating Equipment Association reflect the continued low level of activity in the industry. New orders in January, 1958, dropped 59 percent ($3,045,000) from the $7,380,000 new business obtained in January, 1957. Backlog of furnace orders at end of 1957 stood at $73,571,000 compared to the 1956 year-end backlog of $110,810,000, a decrease of 34 percent. In the induction heating equipment field, new business declined only 15 percent to $630,000 in January, 1958 as compared to $744,000 in January, 1957.

Corrosion Course Planned

Planning for the third annual Appalachian Underground Short Course was inaugurated recently in Pittsburgh, Pennsylvania, by 38 members of the course's general committee, chairmanned by C. A. Erickson, Jr., of Peoples Natural Gas Company. The 1958 Short Course, to be held at the West Virginia University, Morgantown, West Virginia, is scheduled for June 10-12. Approximately 35 firms have been authorized to exhibit their products and services at the annual meeting. Planning on the technical program is near completion and will be announced later.

CORRECTION

The footnote on the second column, page 20 of the March 1958 issue should read: "The electric demand was estimated at 800 kw for a load factor of 34.2 percent."

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The Baffle Makes the Difference
Filters out all dust and scale...
High capacity
Low loss
Completely removes all dust and scale. Reduces service problems and pilot light outages. Reversible end for end and top for bottom. Cast iron baffle diverts flow through all parts of filter for maximum efficiency. Non-corrosive mesh screen and filtering material easily removed. Available in cast iron pipe sizes from ½" to 4" and in fabricated steel in larger sizes. Pressures up to 125 psi.
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Appliance Regulators
Pipe Sizes ½" to 2".
Station Regulators
Pipe Sizes 3" to 24". Liquid Seal or Diaphragm Types.
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Pipe Sizes ½" to 24".
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Pipe Sizes ½" and up.
Complete Engineering Cooperation

THERE'S
BIG
PROFIT
IN DITCHING
WITH A
Pow-R-Ditcher

Model 4T Pow-R-Ditcher

You'll **make** more money . . . you'll **save** more money when you dig with the rugged Vermeer 4T Pow-R-Ditcher. Just the machine for laying gas pipe, service lines and for digging foundation footings. Very maneuverable, the 4T Pow-R-Ditcher is only 48" wide, 6' high, 13' long. Digs 6" to 14" wide and can be transported in a pickup truck. A one man self-propelled unit. Thousands in use. The low price will amaze you!

Model W-2 Pow-R-Ditcher

The baby of the Vermeer line, the W-2 digs 2½" to 4" wide, 3' deep at 1' to 10' per minute. Fine for small trenches, for gas and electrical service and shallow water lines. Rugged, heavier-built, self powered and inexpensive.

Write for complete information, literature and low prices on the complete Vermeer Pow-R-Ditcher line . . . or see your nearest Vermeer dealer.

VERMEER
MANUFACTURING CO.

Men At Work

IN THE GAS DISTRIBUTION INDUSTRY

● **M. M. Fidlar** has been appointed senior vice president and **Joe W. Allen,** vice president in charge of distribution, of Mountain Fuel Supply Company, Salt Lake City. These changes were made necessary by the recent retirement of **J. D. Roberts,** former senior vice president.

J. H. Lang

H. A. Titsch

● **Joseph H. Lang** and **Herbert A. Titsch** have been elected assistant vice presidents of Ohio Fuel Gas Company.

● **Albert F. Mullins** has been appointed assistant manager of Grand Rapids district of Michigan Consolidated Gas Company. Mullins will also continue to serve as assistant treasurer of the company.

● **Henry E. Littlehales** has been named assistant director of public information for the American Gas Association. **Lorne S. Waddell,** formerly with Tom Compere & Associates public relations firm in New York, succeeds him as manager of press relations.

● **W. J. Klein,** vice president of Allis-Chalmers Manufacturing Company, has been named director of sales promotion, tractor group. He will direct advertising, sales promotion, and marketing activities for products of farm equipment, construction machinery, and engine-material handling divisions. **R. L. Smith** has been named manager of advertising for the three divisions in the tractor group.

● **Thomas H. Pike, Jr.,** and **John E. Chumbley** have been appointed division vice presidents and **F. E. MacDonald,** controller of Tube Turns, a division of National Cylinder Gas Company. Pike will be in charge of planning and Chumbley will be in charge of general sales operations for the division.

● **Robert L. Beardsley** has been promoted to industrial and commercial sales manager for Washington Natural Gas Company.

● **W. R. Stephens** has been named president of Arkla Air Conditioning Corporation of Evansville, Indiana, a subsidiary of Arkansas Louisiana Gas Company. **Les E. Walbridge,** Arkla general manager, has been elected vice president of the firm which manufactures year-round gas air conditioners and natural gas lights at Arkla's Evansville plant. **B. E. Harrell,** vice president of ALG in charge of gas supply and gas sales, has been named a new director.

● **Edward C. Duffy** and **Howard B. Wakeman** have been elected senior vice presidents of Long Island Lighting Company. Duffy was formerly vice president with responsibility including engineering, construction, and gas operations. Wakeman was formerly vice president with responsibility including community relations and commercial affairs. **Samuel W. Horsfield, Charles Y. Osburn** and **William Welch, Jr.** have been elected vice presidents. Horsfield is in charge of gas operations, Osburn in charge of employee relations, and Welch is in charge of engineering.

● **Howard E. Ford** has been elected vice president of Northern Illinois Gas Company. Formerly assistant to the president of Northern Illinois and vice president of NI-Gas Supply, Inc., Ford will continue his present duties in the latter company, a subsidiary of Northern Illinois.

H. E. Ford

F. E. Manley

● **Francis E. Manley** has been elected vice president of the newly formed Orange and Rockland Utilities, Inc., of Nyack, New York. He has been associated with Rockland Light and Power Company for 34 years.

● Three new directors have been elected to Schield Bantam Company's board of directors. They are: **Robert J. Crossley,** vice president of The First National Bank of Chicago; **Merle A. Miller,** vice president and treasurer of the Joseph T. Ryerson and Son, Inc. Steel Company of Chicago, and **James H. Boyd,** vice president, production of The Fisher Governor Company.

● **Frederick A. Sincock** has been named manager for domestic water heaters manufactured by the Plumbing and Heating Division of American-Standard. This newly created position reflects increased marketing emphasis for the line of gas water heaters recently introduced by American-Standard.

● **Wilbur S. Roberts, Jr.** has been appointed manager of the New Business Division of Stone & Webster Engineering Corporation.

W. S. Roberts, Jr.

R. E. Orton

● **Raymond E. Orton** has been appointed assistant general manager of The Cleveland Trencher Company. Prior to his appointment, he was manager of engineering in the Automatic Transportation Division of Yale and Towne Manufacturing Company.

● **George E. Olmsted** has been elected treasurer of Consumers Power Company. He succeeds **Lewis J. Hamilton** who retired January 31.

J. A. Cushman

H. S. Walker, Jr.

● **Jac A. Cushman,** formerly assistant director of public information, has been promoted to corporate secretary and convention manager of The American Gas Association. He succeeds **Harold S. Walker, Jr.,** who has been named assistant to the managing director.

● **L. L. Whiteneck,** vice president and director of materials research for Plicoflex, Inc. has been elected president of the National Association of Corrosion Engineers. He will take office the last day of the annual conference to be held in March.

● **Pierce W. Butler, Jr.,** has been named manager of the new American Meter plant in Wyalusing, Pennsylvania. He formerly was personnel manager of the Erie, Pennsylvania, plant.

● **Gordon G. Hurt,** national merchandising manager for Norge Division Borg-Warner Corporation, has assumed direction of Norge home appliance advertising. He will be responsible for all national and cooperative advertising as well as merchandising.

● **William L. Wright Jr.** has been appointed general sales manager of Roberts-Gordon Appliance Corporation.

● **Thomas J. Manning** has been appointed plant manager of the new $4-million Cutler-Hammer plant now under construction at Lincoln, Illinois.

● **J. R. Woodfill** has been named manager of industrial gas sales for Northern Indiana Public Service Company. He succeeds **Carl H. Lekberg,** who retired December 1 after a 33 year career with the company.

J. R. Woodfill

J. H. Eiseman

● **John H. Eiseman** has been appointed consultant to the Metalbestos Division, William Wallace Company. He formerly served for 37 years with the National Bureau of Standards and was recipient of the gas industry's 1957 Distinguished Service Award.

● Appointment of five Michigan Consolidated Gas Company executives to new posts has been announced: **Robert B. Allen,** superintendent of the street department, has been named assistant manager of operations. **Robert C. Barfknecht,** assistant superintendent of the street department, has become superintendent. Succeeding Barfknecht is **Robert W. Cornwell,** former general foreman of the street department. New general foreman is **Hans T. Thomson. Clifford A. Mogk** has been appointed superintendent of operations staff.

● **H. M. Carnahan** has been appointed director of sales of Penn Controls, Inc. He will be responsible for foreign and domestic sales activities.

● Recent personnel changes at Pioneer Service & Engineering Company include: **Winsor Martin,** manager of the rate and research division, has become rate consultant. Active management of the rate division will be assumed by **Donald H. Callen. E. V. Cullen,** vice president and chief purchasing engineer, has assumed promotional and special assignments. He is succeeded by **J. J. Cuniffe** as chief purchasing engineer. **D. C. Hormell,** vice president and chief engineer, has become vice president and consulting engineer and is succeeded by **Carl R. Barthelemy** as vice president and chief engineer. **L. J. Booth,** mechanical engineer, has become chief mechanical engineer, replacing Barthelemy. **L. M. Davis** has been elected vice president and chief structural engineer.

Lancaster Processing Makes Leather Soft, Supple, to Hold Oil Longer—Yet Keeps Leather Firm.
Extra Strong, Extra Rigid Grooved Metal Rims Hold Leather Firmly in Place.
"A Meter is only as Accurate as its Parts"
Endless metal Rings Draw Leather Evenly for Uniform Thickness and Pocket Depth.

Lancaster

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STAND-OUT PERFORMANCE

Time-tested . . . meter proved . . . Lancaster Diaphragms are carefully built and precisely balanced.

Lancaster all-leather, and metal-rimmed diaphragms assure accuracy of Sprague, Ironclad, Tobey and tin gas meters.

For 1-A Sprague Gas Meters, Lancaster offers diaphragms complete with built-in adjustable carrier wire assembly that makes installation faster and easier!

Quality-built Lancaster Diaphragms are the Heart of Accuracy!

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Cork Gaskets
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New Equipment

FOR THE GAS DISTRIBUTION INDUSTRY

For more information on items described here in brief, use the handy reply card and circle the corresponding numbers

Side-Boom Attachment. Side-boom attachment for its Model HO "Payloader" tractor-shovel has been announced by The Frank G. Hough Company. Manufactured exclusively for the "Payloader" by Superior Equipment Company, the 10 ft hydraulically controlled boom provides a maximum lifting capacity of 5½ tons. Standard boom is adjustable in 2-ft increments, telescoping from 10 to 16 ft. A hydraulically extended boom is also available. Positive precision control of the boom at all times eliminates danger to operator from boom cables when boom is lowered into working position. Combination of boom and bucket operating tools on a single, highly mobile unit adds handy "lift and carry" facility, lets Payloader alternate between boom and bucket work at any time. Equipped with boom, Payloader can load or unload, string or lower all types of pipe, set valve or reclaim pipe in maintenance operations. *The Frank G. Hough Company.*

CIRCLE (49) ON THE REPLY CARD

Road Markers. Low cost emergency road markers are available from Signal-Lite Road Marker Company. Made of cardboard, safety signal is two-sided and diagonally banded with broad alternate stripes of light reflective beaded paint and daylight glow paint, both weatherproof colors. Marker stands 12-in. high and 6¾-in. wide. *Signal-Lite Road Marker Company.*

CIRCLE (50) ON THE REPLY CARD

Tool Boxes for Pickup Trucks. Morrison Steel Products has introduced a newly improved line of tool boxes to fit all makes of pickup trucks and accommodate all standard packaging of small parts and equipment. Boxes are available in three standard lengths — 75, 90, and 105-in. Doors have new patented paddle locks, flush mounted for safety and appearance, with slam-action safety catch. Double layer door construction provides flat work table when door is open. *Service Body Division, Morrison Steel Products, Inc.*

CIRCLE (51) ON THE REPLY CARD

Aluminum LP-Gas Meter. American Meter's new aluminum case LP-Gas meter is designed to provide metered service for small commercial loads and medium-size homes with LP-Gas heating. Meter combines extreme resistance to impact damage with compact, light-weight design that facilitates setting and handling. Rated capacity is 110 cfh propane at ½-in. wc differential. Working pressure is 5 psi. Unit is available with ⅜, ½, or ¾-in. F. P. T. connections. One-piece, die-cast aluminum bodies are precision machined for complete parts interchangeability. *American Meter Company.*

CIRCLE (52) ON THE REPLY CARD

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SAVE MONEY, TIME, CALL-BACKS!

The Amazing AQUA VALVE BOX LOCATOR

$29.50 F.O.B. Cin., Ohio

Your Name In Gold FREE!

SURE LOCATIONS EVERY TIME!

- NO WIRES, BATTERIES or SWITCHES — simple, powerful magnetic action, factory adjusted to YOUR geographical location assures unfailing results!
- NO NEEDLE SPINNING — exclusive electric braking action saves you time!
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- NATION'S MOST WIDELY USED LOCATOR!
- 15-DAY FREE TRIAL — No money! No obligation! You be the judge!

ORDER NOW — Wire or call Kirby 1-4200 collect for fastest delivery!

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PIPE STOPPERS OF ALL KINDS

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SAFETY GAS MAIN STOPPER CO. INC.

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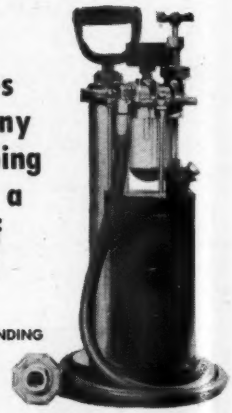
DRAGNET leak detector

detects and locates leaks on any pressure piping system in a matter of minutes!

PATENTS PENDING



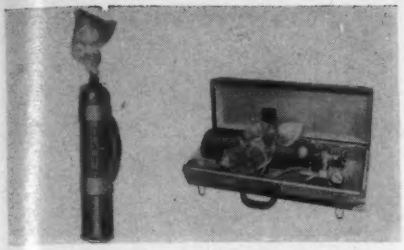
Here's the newest time-saver in the industry! The compact, portable Dragnet Leak Detector will detect even the tiniest leak on any pressure piping system for gas, steam, water or refrigeration. Unique "bubble action" principle much faster than by using pressure gauge or manometer.

SEND FOR BULLETIN 545

UNIVERSAL CONTROLS CORPORATION

P. O. Box 13122

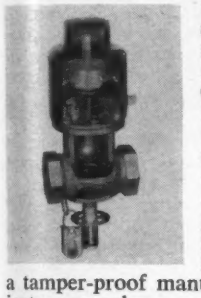
Walnut Hill Sta. — Dallas, Texas



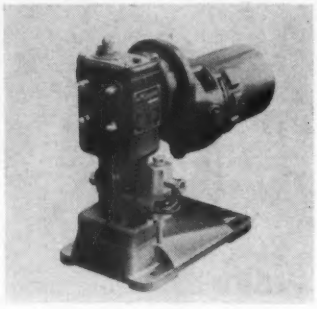
Emergency Oxygen Inhalators. Davis is now offering three new emergency oxygen inhalator models. One, a lightweight inhalator weighing only 21 lb in case, has a 50 minute oxygen supply at 100 percent oxygen. Two and 16 cu ft capacity inhalators also are available. All models are assembled with oxygen dilution valve, hose, disposable facepiece, breathing bag, pressure regulator (UL approved) and oxygen supply. *Davis Emergency Equipment Company, Inc.*

CIRCLE (52) ON THE REPLY CARD

Combination Valve. New combination valve that provides manual shut-off and automatic safety shut-off has been announced by Handley-Brown Heater Company. Called the Master Poly-Trol, valve automatically shuts-off gas in event of excessive pressure, inadequate pressure, high temperature, and flooding besides providing a tamper-proof manual shut-off. In most instances, valve pays for itself by replacing service cock, eliminating need for a regulator vent, and by allowing use of a non-seal regulator in place of expensive seal type regulator. Master Poly-Trol is designed to be installed where service cock is normally located, ahead of the house regulator and meter. Available in sizes ¾, 1, and 2-in. Shut-off data for the three models are: Overpressure—20-in. or 25-in. ± 2 in. wc; Underpressure—1½ in. or 2 in. ± .1 wc; Temperature—Approximately 160 deg F. *Handley-Brown Heater Company.*

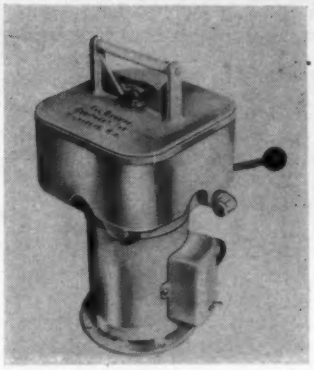


CIRCLE (53) ON THE REPLY CARD



Packless Metering and Proportioning Pump. New more compact model of Hills-McCanna Company's McCannameter metering and proportioning pump is now available. Called the integral McCannameter, unit occupies only one-third the space previously required. Has continuous flow characteristics throughout the entire capacity range. Capacity is adjustable while in operation, pumping at pressures up to 2500 psi. Unit available with either teflon-faced diaphragm or metallic bellows. *Hills-McCanna Company.*

CIRCLE (54) ON THE REPLY CARD



Portable Hydraulic Motor Pumps. Tal Bending Equipment, Inc., has developed a small, powerful, portable hydraulic motor pump capable of developing up to 10,000 psi and weighing only 65 lb. It is designed for use with Tal hydraulic pipe benders, or any other make of hydraulic bender, pipe pushers, or hydraulic jacks. Can be readily installed and adapted to give fast continuous power to existing equipment. Pump is rated for 10,000 psi intermittent and 5,000 psi continuous duty, delivery 80 cu in. of oil per min. *Tal Bending Equipment, Inc.*

CIRCLE (55) ON THE REPLY CARD

Pilot Light Definitions: Atheist — a football fan who doesn't care who wins the Notre Dame-Southern Methodist game. Middle Age — when a guy keeps turning off lights for economical rather than romantic reasons. Humiliation — a common emotion caused by suddenly shrinking to one's normal proportions.

Branding Time

Time to "Tally the Herd" and "Round up the Strays".

Gas companies, nationwide, profitably use Southern Cross Foresters gas leak "Round-up" services . . . leak location surveys and when needed, fully equipped fully trained repair crews.

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New Equipment

Pipe Line-up Clamp. Lever grip line-up clamp to hold pieces of pipe in alignment when they are being welded is now available from A & H Engineering Co. Clamp is used when welding together lengths of pipe and when making tie-in welds. It is unnecessary to hold the clamp once it is attached to the ends of the pipe. Unit can be quickly installed, removed, and adjusted to handle pipe sizes ¾- through 2-in. *A & H Engineering Company.*

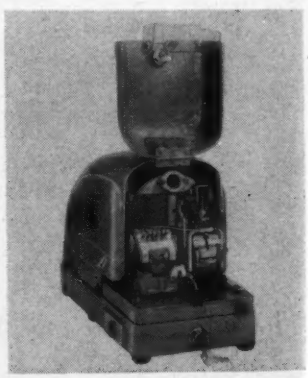
CIRCLE (56) ON THE REPLY CARD

Steam-Hydraulic Jet Cleaner. New combination steam and hydraulic jet cleaning unit, has been designed especially for use in heavy duty industrial cleaning jobs by Clayton Manufacturing Co. and Sellers Injection Corporation. Units provide either steam cleaning for high impact, heavy duty close-up cleaning, or a hot hydraulic jet stream for cleaning distant surfaces, particularly those covered with caked mud, grease, ice, etc. As a steam cleaner, it produces 280 gal per hr at 90 to 100 psi, maximum volume and pressure usable at close range through a single nozzle. Can also be converted to a one or two-gun operation at 140 gph per gun. *Clayton Manufacturing Company.*

CIRCLE (57) ON THE REPLY CARD

Pipe Finder-Leak Detector. New transistorized combination pipe finder-leak detector has been developed by Fisher Research Laboratory. Detector has had 12 months of laboratory research and field testing. Unit combines advantages available through new electronic techniques and materials. Transistors, printed circuits, indestructible Fiberglas cases, and single turn solid aluminum detecting loops are used. These technical advances mean more accurate, more efficient, more durable, and more economical detector with greater depth penetration than previously available. Battery life in new unit is estimated to be 1500 hours of continuous operation—battery life in excess of one year of normal field use between battery changes. Other features include simplified operation procedure, built-in battery testers, power selection control, detachable carrying belt, and complete illustrated instructions. *Fisher Research Laboratory, Inc.*

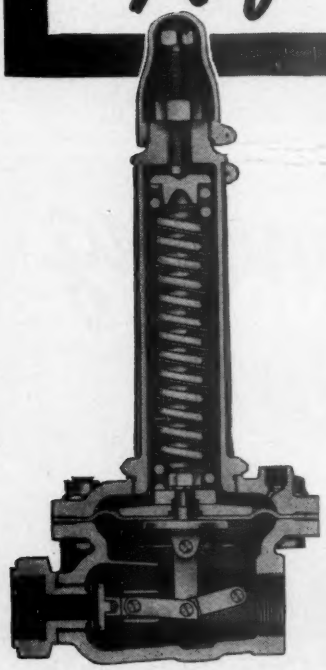
CIRCLE (58) ON THE REPLY CARD



Payment Puncher for Post Card Bills. Machine to record receipt of payment on post card type bills used in conjunction with punch card tabulating systems has been developed by Heller Roberts Manufacturing Corporation. Receiptor perforates customer's receipt with paid, date, location number, company initials and teller numbers; prints stub with date and teller number, and automatically detaches stub from the receipt. The electrically operated, motor driven machine is equipped with door lock, ignition lock, safety guards, and a safety switch so that the machine will not operate when door is open. *Heller Roberts Manufacturing Corporation, American Perforator Div.*

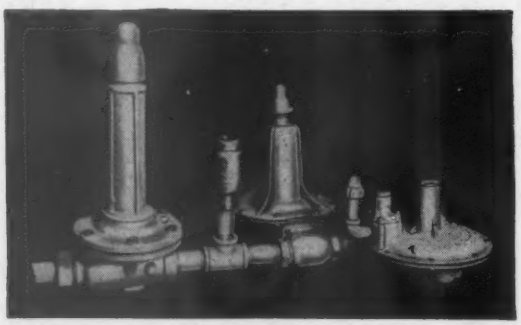
CIRCLE (59) ON THE REPLY CARD

IN THE HIGH PRESSURE FIELD
THERE IS SAFETY
IN *Reynolds*...



Accurate, Safe Control

of tremendous pressures is an ever present problem in the gas field. Reynolds field Regulator illustrated at left is one of the many high pressure regulators built by Reynolds. It is thoroughly tested and proved in service. It handles up to 1,000 pounds safely reducing same to pounds. For more than fifty-five years Reynolds has designed and built gas regulators. Safety, accurate performance, years of service—these are some of the built-in factors responsible for Reynolds enviable position in the Gas Control Field.



Reynolds Gas Regulator Co.
ANDERSON, INDIANA, U. S. A.
GAS CONTROL SINCE 1892

see how easily you can
change over units on the new

ROBERTSHAW Unitrol® 1000*

Start with Basic Unitrol 1000 for *manual space heater operation.*

- 100% automatic shut off of pilot and main burner
- A & B gas valves, pilot filter and pilot adjustment

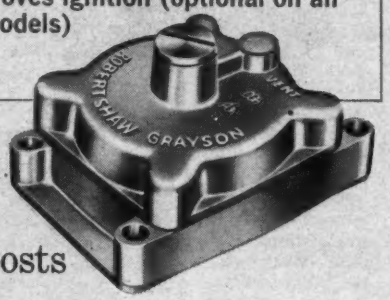
Install any of these hydraulic thermostatic units for automatic *space heater operation.*

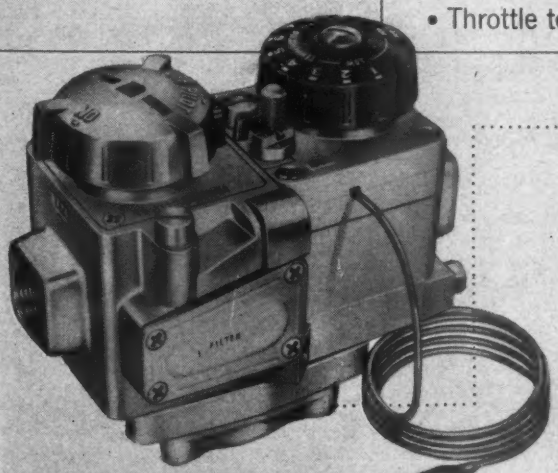
- Snap action, self-contained
- Snap full on
- Snap to bypass
- Snap to high flame—throttle down to bypass—snap off
- Throttle to bypass

or change over to *wall thermostat operation* by installing:

- 24 volt electric unit

Gas pressure regulator improves ignition (optional on all models)





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* cuts inventory costs
* standardizes manifold assemblies
* cuts application costs
* saves space—compact
* cuts service costs

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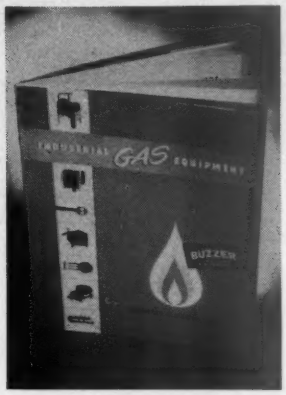
Bulletin Board

NEW BOOKS...BROCHURES...CATALOGS

For more information on items described here in brief, use the handy reply card and circle the corresponding numbers



Industrial Gas Burners. New catalog illustrates and describes Hones full "Buzzer" line of industrial gas burners, furnaces, and accessories for heat treating, metal melting, soldering and drying. Sections on special furnaces and manual and automatic controls are also included. Accurate dimensional and Btu performance tables as well as temperature curves and work rate charts on the equipment are included to assist in the proper selection of furnaces. *Charles A. Hones, Inc.*

CIRCLE (94) ON THE REPLY CARD

Portable Electric Plants. How one man, with a portable electric plant, can do the work of a crew is explained and illustrated in a new folder just released by D. W. Onan & Sons, Inc. Units provide adequate electric power for concrete vibrators, electric saws, drills, and other equipment, as well as area floodlighting. Brochure also describes how special service centers throughout U. S. and Canada with complete stocks of engine and generator parts, and trained service men offer better and longer service for Onan plant owners. *D. W. Onan & Sons, Inc.*

CIRCLE (95) ON THE REPLY CARD

Digging Tools and Accessories. Catalog of Ingersoll-Rand's line of digging tools and accessories has been published in a new bulletin entitled "Accessories for Demolition and Digging Tools." The 24-page bulletin includes a page on reforging, sharpening, and the proper method of hardening tools which may be detached from bulletin to be used as a wall chart. Special section describes safety tools of forged beryllium copper which can be used where sparks can't be tolerated. Sixteen variations of digging and demolition tools and 64 accessories are described. *Ingersoll-Rand Company.*

CIRCLE (96) ON THE REPLY CARD

Directory for Electrode Selection. New 12-page weldirectory has been published by The Lincoln Electric Company covering the selection of the most efficient electrode for any particular welding job. Basic characteristics of each family of electrodes are described including deposition, arc action, amount of slag, bead appearance, and general applications. Directory differentiates between individual electrodes within the family and gives physical properties, current ranges, sizes, and welding procedures for each electrode. *The Lincoln Electric Company.*

CIRCLE (97) ON THE REPLY CARD

Tractor. Complete specifications and information on the four wheel drive, four wheel steer "Crab" tractor have been published by Napco Industries, Inc., in a new five-page, two-color brochure. Tractor features include torque converter and drive selector. Specific applications of the unit are pinpointed. *Napco Industries, Inc.*

CIRCLE (98) ON THE REPLY CARD

Appliance Service Manual. Data on installation and servicing of more than 70 types of gas ranges, water heaters, clothes dryers and incinerators has been published by the Utilization Bureau of the American Gas Association in a new edition of the AGA Gas Appliance Service Manual. The 570-page manual contains 370 illustrations and includes information on wiring diagrams, circuit checking procedures, single point ignition, electric ignition, clocks and timers, and automatic top burner heat control. *$3.25 for single copy. American Gas Association.*

CIRCLE (99) ON THE REPLY CARD

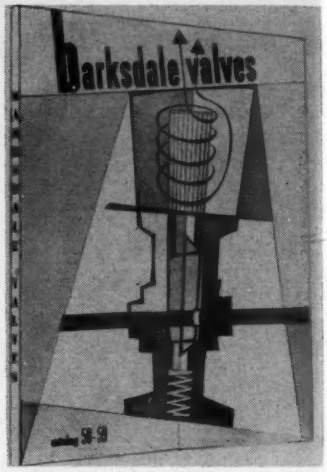
BOOKSHELF

The Material Handling Handbook, *edited by Harold A. Bolz. Published by Ronald Press, New York. Pages, 1750. Price, $20.00.*

New volume on materials handling, most complete reference work available on the subject, has been prepared under the sponsorship of the American Material Handling Society and the Materials Handling Division of American Society of Mechanical Engineers. Handbook was in preparation for more than five years under the direction of a joint committee of ASME and AMHS members, whose chairman is Herbert H. Hall of the Aluminum Company of America. Illustrated with photographs, charts, tables, and diagrams, the volume is divided into 47 sections covering methods of analyzing handling problems, principles, procedures and techniques for effective operation and control; systems design and installation, and design, selection and classification of materials handling equipment. All types of conveyors, winches, cranes, powered and hand trucks, marine, air and railroad carriers and terminals, and warehouse and yard handling are included.

Phase Relations of Gas Condensate Fluids — Test Results, Apparatus, and Techniques, *published by the American Gas Association, 420 Lexington Avenue, New York 17, New York. Pages 439. Price, $10.*

New book describes fundamental research conducted by the Bureau of Mines, U. S. Department of the Interior, in cooperation with the American Gas Association, culminating 20 years of study of fluids in high pressure reservoirs. Publication is Volume I of a two volume monograph. Fundamentals are reviewed in one of the eight chapters, test results are reported in five of the chapters, and two chapters are devoted to correlations. Chapters in Volume II, now in preparation, will pertain to correlations of test results.



Valve Catalog. Barksdale's line of "Shear-Seal" valves is defined in detail in their new 56-page catalog. Characteristics and data to aid in selection and application of valves are included. Detailed cross-section illustrations, simple graphs for determining pressure drop, discharge and velocity of liquids, and a pressure conversion chart scaled from 0 to 3000 psi are included in the catalog. Valves feature the "Shear-Seal" leak proof principle and are rated for oil and water pressures from 0 to 10,000 psi and air pressures from 0 to 10,000 psi in four way, three way shut-off and diverter flow patterns, manual and solenoid. *Barksdale Valves.*

CIRCLE (100) ON THE REPLY CARD

Backhoe Catalog. Two-color, 16-page catalog features design and performance characteristics of new model Hyster D4 hydraulic backhoe, which was built to operate as an integral unit on the Caterpillar D4 tractor and the 955, HT4 Traxcavators. Matched equipment provides mobility and versatility to meet wide variety of job demands, including trenching for gas lines, excavation for tank pits, irrigation ditches, foundations, and other utility digging jobs down to 13 feet below the grade. *Hyster Company.*

CIRCLE (101) ON THE REPLY CARD

Job-Site Safety. How to set-up and enforce a job-site safety program on construction projects is outlined in a new 16-page booklet now available from National Constructors Association. Booklet describes how to organize a safety committee, how to indoctrinate new employees, what medical arrangements to make, how accidents should be reported, what fire precautions should be taken, and suggests a schedule for safety inspections. *National Constructors Association.*

CIRCLE (102) ON THE REPLY CARD

WSP Bronze Valves. Walworth has issued a new bulletin on its 150-lb WSP bronze globe, angle, and check valves. Service ratings, dimensional drawings for each type valve, and an exploded view of a globe valve with matching text for each component are included in the bulletin. Bronze valves in the 150-lb line feature hard composition, all-purpose discs suitable for use with temperatures up to 500 F and resistant to oil and gasoline at atmospheric temperatures. *Walworth Company.*

CIRCLE (103) ON THE REPLY CARD

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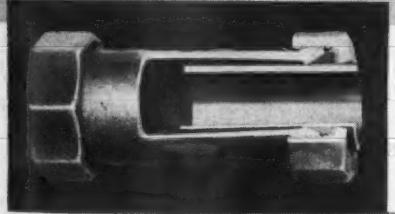

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NORMAC
all malleable
coupling
¾" to 2"

NEW 50 A
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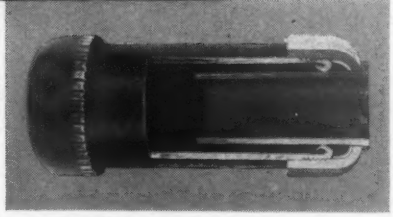
all steel
coupling
¾" to 1¼"



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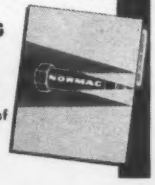

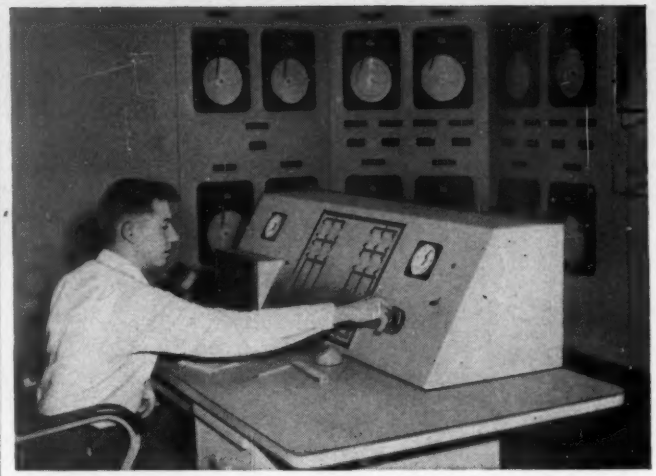

ONE man does the work of many...with AMERICAN® telemetering-telecounting equipment

In the largest gathering fields, along the pipelines, in large and small distribution systems, American telemetering and telecounting equipment substantially reduces personnel required for transmission of meter readings. From a central dispatching station, one man instantly obtains accurate flow and pressure readings at remote points and adjusts for load demands with remote-set controllers.

Your American representative can help you benefit by telemetering and telecounting all or any part of your system—large or small.

For Base Volume Indexes— American Telecounters accurately transmit Base Volume Index indications of gas quantities computed to base temperature and base pressure conditions, to remote locations.

For further information consult your American Meter representative.

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(INCORPORATED / ESTABLISHED 1836)

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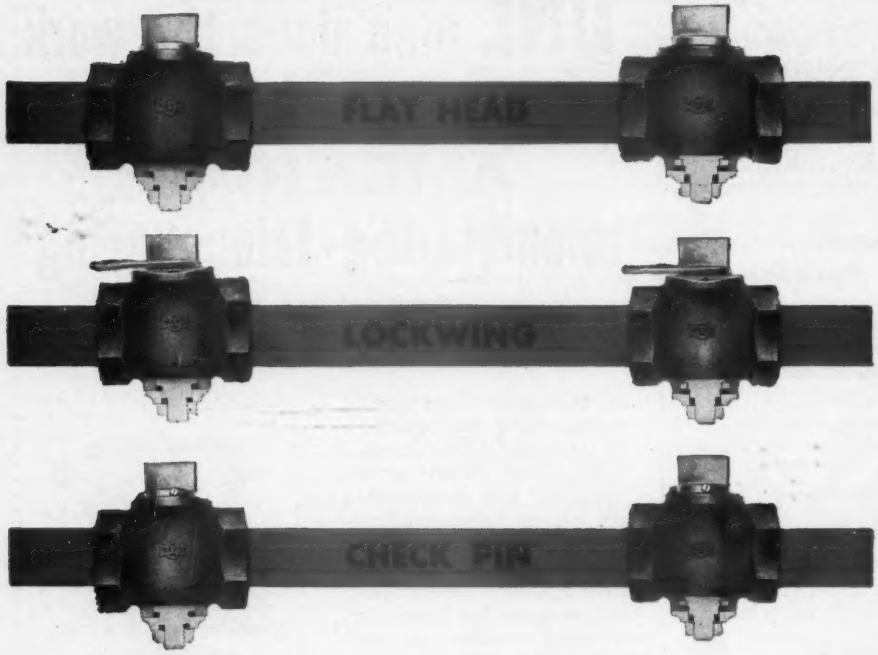

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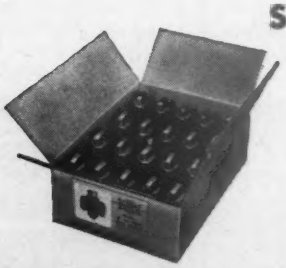

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